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ARTICLE XII.—On *Sanguinaria Canadensis*. By Daniel B. Smith.

Nat. ord. PAPAVERACEÆ.

Lin. meth. POLYANDRIA MONOGYNIA.

SANGUINARIA. Cal. 5-phyl.-deciduous. Petals, 8. Stigma, sessile, 2-grooved. Capsule, superior, oblong, 1-celled, 2-valved, apex attenuated. Receptacles, 2, filiform, marginal.—Nuttall.

S. canadensis. Root tuberous, horizontal, giving out a reddish and very acrid lactescent sap. Leaves solitary, radical, reniform and lobed, scape naked, 1-flowered, sheathed at base, petals variable in number. April and May. Perennial.—Nuttall.

THIS beautiful species is one of the earliest flowering plants of North America, and expands its showy white petals along with the *Hepatica Triloba*, the *Violas* and the *Epigea Repens* beneath the first genial warmth of spring. It grows throughout the United States, and its favourite situation is the shady border of woods in a rich light soil. The root of the *Sanguinaria* is of a rich brown colour, horizontal, abruptly terminated, fleshy, about the thickness of a finger,

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frequently twisted, and very juicy. It may be readily distinguished by the colour of its juice, which is of a bright orange, and tinges woollen or silk of a deep and rather permanent yellowish red. The root is furnished with numerous slender radicles, and makes offsets from the side, which succeed to the old plant, and thus acquire the præmorse character that marks the species. The leaf and flower spring up together; the folded leaf enveloping the scape and flower bud, and rolling back as the latter expands. The stem is simple, smooth, from six to twelve inches in height, and terminated by a single reniform or somewhat heart-shaped deeply lobed leaf. The leaf is smooth, of a deep green on the upper surface and pale or light bluish beneath, and strongly marked by veins, which are tinted with the orange-coloured sap that pervades the whole plant.

The scape is one flowered, round and smooth. The calyx is two-leaved and falls off as soon as the flower opens; its leaves are obtuse and ovate. There are usually eight petals, although they vary from that number to fourteen. The petals are spreading, ovate, obtuse and concave. The stamens are numerous, with yellow filaments, shorter than the corolla and orange-coloured oblong anthers. The germ is oblong, compressed; the stigma sessile, thick, two-furrowed or somewhat lobed, permanent. The capsule is oblong, sharp at both ends, two-valved. The seeds are numerous, round, deep, shining, red, somewhat pointed and having a white arilla.

The blood-root, as it is commonly called, from its most striking peculiarity, is termed Puccoon in the native Indian dialects. It is used as a dye by the Indians to stain their baskets, skins, &c.

Its taste is acrid and bitter, and leaves a strong sensation of heat in the mouth and throat.

Its medical properties are those of an acrid narcotic, acting in doses of from ten to twenty grains as a dangerous, irritant, and emetic. The whole plant possesses active pro-

perties, although the root is the part which has been most carefully examined.

Dr Dana of the university of New York instituted a set of experiments on this root in 1824, and succeeded in obtaining an alkaline substance from it, which is probably the active principle of the plant. This principle, which he calls *sanguinarina*, may be obtained by digesting the finely powdered root in absolute alcohol, and adding to the tincture, a solution of ammonia, so long as it occasions any precipitate. A gray powder falls down, which is to be collected and boiled in water with some pure animal charcoal and the liquid then filtered. Alcohol is to be digested on the matter remaining on the filter, and afterwards evaporated to dryness. A white, pearly substance remains, having an acrid taste, rendering brown the yellow of turmeric, and changing the infusion of purple cabbage to a green. This substance is the *sanguinarina*. It is very sparingly soluble in water; but is soluble in ether and very soluble in alcohol. With tincture of galls it affords a precipitate soluble in alcohol, but insoluble in ammonia. It combines with acids and forms salts, which all present some shade of red, crimson or scarlet, of great intensity and beauty. The salts are soluble in water and alcohol, and form red coloured solutions of great beauty. The muriate and the acetate are peculiarly pungent and acrid. When the salts of *sanguinarina*, prepared with diluted acids, are decomposed by potassa, ammonia, lime or magnesia, the vegeto-alkali is obtained in an unaltered state. But, if the salt has been prepared with concentrated acid, the decomposition is not complete, but a dark purple precipitate is formed which appears to be a sub-salt.

The experiments of Dr Dana have been so far repeated as to confirm his principal statements, of the characters of this new alkaline principle. The subject is one which merits further elucidation, and we wait with impatience for the publication of the researches of Dr Augustus Hayes, who was engaged in these inquiries at the date of Dr Dana's publication in 1827.

The medicinal properties of sanguinaria have been carefully investigated by Dr Tully, an eminent practitioner of New Haven, Conn., who attributes to it the virtues of squill, seneka, digitalis, guaiacum and ammoniacum.

The leaves are said by Dr Downey to be in use by the farmers in Maryland, in diseases of horses, to make them sweat, and Dr B. S. Barton says the seeds are violent narcotics, resembling those of stramonium in their properties.

The plant belongs to the natural order of papaveraceæ, and possesses the leading properties of that order.

The United States Pharmacopœia directs a tincture made with four ounces of the bruised root, to two pints of alcohol, the dose of which is a small teaspoonful.

Dr Bigelow says, that many physicians prefer an infusion made with a drachm of the powder to a gill of water, a table spoonful of which is a dose.

It is said to form the principal ingredient in Rawson's bitters, which have gained much celebrity as a remedy in jaundice. The root loses much of its acrimony in drying, and should therefore be frequently renewed in the shops, where it has become a regular article of sale.

ART. XIII.—*Dissertation upon the subject of Peruvian Bark.*
By Geo. B. Wood, M. D.

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Commercial history.—For more than a century after the Cinchona came into use, it was procured almost exclusively from Loxa, and the neighbouring provinces. In a memoir published A.D. 1738, La Condamine speaks of the bark of Rhiobamba, Cuenca, Ayaraca, and Jaen de Bracomeros. Of these places, the two first, together with Loxa, lie within the

ancient kingdom of Quito, at its southern extremity; the others are in the same vicinity, within the borders of Peru. The drug was shipped chiefly at the port of Payta, from which it was carried to Spain, and thence spread over Europe. Beyond the limits above mentioned, the Cinchona was not supposed to exist, till, in the year 1753, a gentleman of Loxa, familiar with the aspect of the tree, discovered it while on a journey from the place of his residence to Santa Fe de Bogota, in numerous situations along his route; wherever, in fact, the elevation of the country was equal to that of Loxa, or about six thousand five hundred feet above the level of the sea. This discovery extended quite through Quito into the kingdom of New Granada, as far as $2\frac{1}{2}^{\circ}$ north of the equator. But no practical advantage was derived from it; and the information lay buried in the archives of the vice-royalty till subsequent events brought it to light.

To Mutis undoubtedly belongs the credit of making known the existence of the Cinchona in New Granada. He first discovered it in the neighbourhood of Bogota, in the year 1772. A botanical expedition was sometime afterwards organized by the Spanish government, with the view of exploring this part of their American dominions; and the direction was given to Mutis. The researches of the expedition eventuated in the discovery of several species of Cinchona in New Granada; and a commerce in the bark was soon commenced, which was afterwards increased, and carried on with great vigour through the ports of Carthagena and Santa Martha. The English and North Americans, opening a contraband trade with these ports, were enabled to undersell the Spanish merchant, who received his supplies by the circuitous route of Cape Horn; and the barks of New Granada were soon as abundant as those of Loxa, in the markets of Europe.

To these sources another was added about the same time, A.D. 1776, by the discovery of the Cinchona in the centre of Peru, in the mountainous region about the city of Huanuco, which lies on the eastern declivity of the Andes, to the N. E. of Lima, at least 6° to the south of the province of

Loxa. To explore this new mine of wealth, another botanical expedition was set on foot, at the head of which were Ruiz and Pavon, the distinguished authors of the *Flora Peruviana*. These gentlemen spent several years in this region, during which time they discovered the numerous species that were afterwards described in their *Flora*. Several of their species, however, are now considered identical with the *C. lancifolia*, previously described by Mutis. Lima became the entrepot for the barks collected around Huanuco; and hence originated the name of Lima bark, so often conferred in common language, not only upon the varieties received through that city, but also upon the medicine generally.

Soon after the last mentioned discovery, two additional localities of the *Cinchona* were found, one at the northern extremity of the continent near Santa Martha, the other very far to the south, in the provinces of La Paz and Cochabamba, then within the vice-royalty of Buenos Ayres. These latter places became the sources of an abundant supply of excellent bark, which received the name of Calisaya, probably from a district of country where it was gathered. It was sent partly to the ports on the Pacific, partly by a much longer passage to Buenos Ayres.

The consequence of these discoveries, following each other in such rapid succession, was a vast increase in the supply of bark, which was now shipped from the ports of Guayaquil, Payta, Lima, Buenos Ayres, Carthagena, and Santa Martha. At the same time, the average quality was probably deteriorated; for, though many of the new varieties were possessed of excellent properties, yet equal care in superintending the collection and assorting of the article could not be exercised, now that the field was so extended, as when it was confined to a small portion of the south of Quito, and north of Peru. The varieties which were poured into the market, soon became so numerous, as to burthen the memory, if not to defy the discrimination of the druggist; and the best pharmacutists found themselves at a loss to discover any permanent peculiarities which might serve as the basis of a proper and

useful classification. This perplexity has continued, more or less, to the present time; though the discovery of the new alkaline principles has presented a ground of distinction which was before unknown. The restrictions upon the commerce with South America, by directing the trade into irregular channels, also had a tendency to deteriorate the character of the drug. In the complexity of contrivance to which it was necessary to resort, to deceive the vigilance of the government, little attention could be paid to a proper assortment of the several varieties; and not only were the best barks mixed with those of inferior species, and less careful preparation; but the products of other trees bearing no resemblance to the *Cinchona* were sometimes added, having been artificially prepared so as to deceive a careless observer. The markets of this country were peculiarly ill-furnished. The supplies, being derived chiefly by means of a contraband trade with Carthagena and other parts of the Spanish main, or indirectly through the Havannah, were necessarily of an inferior character; and our traders, finding a better market in Europe for the superior kinds, brought home only the refuse of their cargoes. A great change, however, in this respect has taken place since the ports on the Pacific have been opened to our commerce. The finest kinds of bark have thus been rendered directly accessible to us; and increased intelligence in the community has co-operated with the facility of supply, to exclude from our markets, that kind of trash with which they were formerly glutted.

A curious account is given by Humboldt of the influence of commercial monopoly, over the reputation of the different kinds of bark. So long as Loxa and its neighbourhood continued to be the only source of supply, the complete control of the trade belonged to a few mercantile houses at Cadiz; but after the discovery of the *Cinchona* trees by Mutis in New Granada, it was found impossible to confine the commerce in this article within such narrow limits; and it became a matter of importance to those houses to undervalue what they could not make conducive to their own pecuniary advantage.

Complaisant botanists were found who denied the identity of the species of *Cinchona* growing about Bogota, with those of the original locality in the south of Quito; and physicians undertook to decide that the efficiency of the various barks depended upon their growth within certain degrees of latitude. As the trade in the barks discovered about Huanuco in Peru naturally came into the same hands with that of the barks of Loxa, the former were not found to deserve equal condemnation with those to the north of the equator. So great an influence was exerted over public opinion in Spain, by this self-interested combination, that a quantity of the orange-coloured bark of Santa Fe de Bogota which had been collected by Mutis in New Granada, was condemned to be burned in the public market place of Cadiz. A part of the bark, thus destined to the flames, was secretly bought by English merchants and shipped to London, where it brought great prices. This influence, however, did not extend beyond Spain and perhaps France; for the barks of New Granada, which were brought by the contrabandists into Europe from Carthagená and Santa Martha, had the preference in England, Germany, and Italy, over those imported by the route of Spain.

The above account, however, though given by Humboldt, should be received with much allowance. This philosophic traveller, having had much intercourse with Mutis, and perhaps enjoyed his hospitality in South America, was very naturally influenced by his representations, which were not those of an impartial observer. The part performed by Mutis in the discovery of the barks of New Granada, and in their introduction into use, enlisted his partialities in their favour, and neither he nor his pupils could listen with complacency to the claims of superiority which might have been honestly urged in favour of those of Quito and Peru. Whatever might have been the motives of the merchants, botanists and physicians, whom Humboldt intimates to have conspired against the produce of the *Cinchona* of New Granada, it is certain that time has confirmed, to some extent at least, the

correctness of their representations ; for it is now universally admitted, that the Carthagena barks are in every respect inferior to those derived from the ports on the Pacific ; and the conjecture has been ventured, that the bark condemned to be burned at Cadiz might have merited its sentence.

The persons who collect the bark are called in South America, *Cascarilleros*. Considerable experience and judgment are requisite to render an individual qualified for this business. He must not only be able to distinguish the trees which produce good bark from those less esteemed ; but must also know the proper season and the age at which a branch should be decorticated, and the marks by which the efficiency or inefficiency of any particular product is indicated. The dry season, from September to November inclusive, is the harvest of the bark-gatherers. They separate the bark by making a longitudinal incision with a sharp knife through its whole thickness, and then forcing it off from the branch with the back of the instrument. Other means are resorted to when the trunk or larger limbs are decorticated. They consider the branch to be sufficiently mature, when the inner surface of the bark begins to redden upon exposure to the air, within three or four minutes after its removal. The next object is to dry the bark in the sun. In the drying process it rolls itself up, or in technical language becomes quilled ; and the degree to which this effect takes place, is in direct proportion to the thinness of the bark, and in an inverse ratio to the age of the branch from which it was derived.

In packing the bark for exportation, due care is seldom taken to assort the varieties according either to the species of *Cinchona* by which they are furnished, or to their resemblance in appearance and character ; and it often happens that several different kinds are introduced into the same case. The packages are, in commercial language, called *seroons*. As found in this market, they are covered with a case of thick and stiff ox hide, which is lined within by a very coarse cloth apparently woven out of some kind of grass. Occasionally even very good bark is bound up in bags of this coarse cloth,

without any covering of skin, so that air and moisture are freely admitted, and the drug is thus exposed to injury. This was the case with some very fine red bark which came under my own notice, recently imported from Guayaquil.

The American druggists, till within a few years, derived their best bark from London, whither it was brought from Cadiz; but since the commerce with South America has been freely opened to us, we have been enabled to supply ourselves immediately from the places of production. Our ships, trading to the Pacific, run along the American coast from Valparaiso in Chili to Guayaquil, on the western coast of Colombia, stopping at the intermediate ports of Coquimbo, Copiapo, Callao, Truxillo, &c., from all which they probably receive supplies of bark, in exchange for the mercury, piece goods, flour, &c., which constitute their outward cargo.

Means of distinguishing good Bark.—To the druggist and apothecary, it is highly important to possess the means of deciding upon the relative value of the numerous varieties of bark of every quality brought into market, or at least of discriminating between the energetic and inefficient. The following rules are given by men who pretend to a familiar acquaintance with the subject. They are essentially the same with those which, according to Dr Devoti, a physician of Lima, are practised in South America, in choosing the barks proper to be admitted into commerce.

In forming a judgment, it is necessary to consider whether the bark has been taken from a branch of the proper age, and whether it has been carefully dried. Very young bark has not acquired the virtues which render the medicine valuable; that derived from the trunk or older branches has often been injured by time, or by the action of parasitic plants; and to hasten the drying process in some mountainous situations where the sun has little power, or to increase the rolling, a certain degree of which renders the drug more saleable to the merchants, it is said not to be an uncommon practice to expose the fresh barks injuriously to artificial heat. Bark more than an inch and a half in width must have come

from the trunk or great branches; that which is smaller than a goose quill, from young and immature branches; and both are deemed of inferior quality. The same remark is applicable to the degree of thickness; but in forming a judgment on this point it is necessary to take the species into consideration. Though, as a general rule, very thin or very thick bark is of inferior quality, yet specimens have been found very effectual upon trial, which have not fallen within the limits usually esteemed the most proper in this respect. That which exceeds a line in thickness is said not to be esteemed at Cadiz. The specific gravity of bark is also considered, in some measure, a criterion of its value, the heaviest being most esteemed. The fracture should be to a certain extent, splintery: if sharp and short, it indicates too great age: if the fibres are very long, there is reason to apprehend a want of maturity. The rolling of a bark affords another ground of judgment, though by no means to be relied on, as some excellent varieties are almost or quite flat. A feeble rolling indicates a bark too old or too slowly dried; a spiral form, one that has been gathered before it was ripe, or afterwards exposed to an improper degree of heat. The effects of heat are also observable in the darker colour of the bark, and the appearance of whitish stripes of a sickly hue on the inside.

Some dependence is placed by the South Americans upon the appearance of the epidermis; and the following commercial varieties have had their origin in this source: 1. *Negrilla*, blackish; 2. *Crespilla*, crisped; 3. *Pardo-obscura*, dark leopard-gray; 4. *Pardo-clara*, bright leopard-gray; 5. *Lagartijada*, silver or lizard-coloured; 6. *Blanquissima*, very white; and 7. *Cinicienta*, ash-coloured. The first three are most esteemed. It is possible that among those well skilled in the subject, and thoroughly acquainted with the Cinchona tree in its natural state, inferences may be drawn from these appearances, as to the elevation upon the mountains, the degree of exposure to the sun, and, sometimes, perhaps, as to the species of the

plant: but little reliance can be placed upon them by persons who are not already too well informed to need instruction.

The properties of colour, taste, and smell, are more important. The colour which, according to Dr Devoti, is most highly esteemed is orange; and the gradations of shades from this to white mark a corresponding diminution in value. A dark colour between red and yellow is considered a sign either of inferiority in species, of improper preparation, or of injurious exposure to air and moisture. The taste should be bitter and very slightly acid, but not acrid, nauseous, nor very astringent. The odour of bark is never very strong; but this quality exists in some degree in the better kinds, and affords a favourable sign when it is decided or peculiar, without being disagreeable.

These remarks are of general application: they will be further extended, when the varieties of bark are separately described.

Classification.—To form a correct and lucid system of classification, is the most difficult part of the subject of bark, which is throughout full of perplexities. An arrangement founded on the botanical species, though the most scientific and satisfactory when attainable, is in the present instance utterly out of the question. There are few varieties of the precise origin of which we can be said to have any certain knowledge, by far the greater number being either derived from an unknown source, or but obscurely traceable to their native tree. Pharmacutists, indeed, are not wanting, who are disposed to ascribe all the genuine barks, yielding quinia and cinchona, to the same species of *Cinchona*. Guibourt has recently advanced the opinion that they are all derived from varieties of the *C. lancifolia*; and adduces in support of it the statement of La Condamine, that when at Loxa he was informed, on good authority, that the barks could not be distinguished by the eye.

The Spanish merchants adopted a system of classification dependent partly on the place of growth, or shipment, and

partly on some inherent property, or on the supposed relative value of the bark. So long as the sources of the drug were very confined, and the number of varieties small, this plan answered the purposes of trade: but at present it is altogether inadequate; and though some of the names originally conferred upon this principle are still retained, they have ceased to be expressive of the fact, are often erroneously, and almost always confusedly applied. The *Loxa* barks embrace, among us, not only those which come from that province, but those also from the neighbourhood of Huanuco, whilst others which have received different names are brought from the same place. It is said that by the traders in South America the young, slender, gray barks are called by the name of *Loxa*, from whatever source they may be derived, while those somewhat larger and older receive their appellation from Lima.

Perhaps the best arrangement for pharmaceutical and medicinal purposes, is that adopted in the United States Pharmacopœia, founded on difference of colour. It is true that dependence cannot be placed on this property alone; as barks of a similar colour have been found to possess very different virtues; and between the various colours considered characteristic, there is an insensible gradation of shade, so that it is not always possible to decide where one ends, and the other begins. Still it has been found that the most valuable barks may be arranged, according to their colour, in three divisions; which, though mingling at their extremes, are very distinctly characterized, in certain specimens, by peculiarity not only in colour, but also in other sensible properties, and even in chemical constitution. The three divisions alluded to are the *pale*, the *yellow*, and the *red*. These may be considered as exclusively the officinal barks: while the inferior varieties, which approach one or other of these classes in colour, but differ in other properties, may be treated as extra-officinal, and considered under a separate head. As these inferior kinds come chiefly, if not exclusively from the northern ports of Colombia, they are known in commerce by the name of Carthagena barks, and by this

name will be described in the present communication. Specimens of little value may be occasionally imported from the Pacific coast of South America; but the quantity is small, as the profit they might yield on their original cost would be inadequate to the expenses of so long a voyage. In describing, therefore, the different kinds of bark, I shall treat *first* of the officinal varieties under the three heads of *pale*, *yellow*, and *red*, and *secondly* of the extra-officinal, under the title of *Carthagena barks*. The commercial name will at the same time be given in all instances in which a knowledge of it can be useful in this country. It is proper here to state that the different barks frequently come to us mingled in the same package, and that in deciding upon the character of a *seroon* the druggist is guided rather by the predominance, than the exclusive existence of certain distinctive properties.

1. *Pale Bark*.

The epithet *pale* applied to these barks is derived from the colour of the powder. The French call them *quinquinas gris* or gray barks, from the colour of the epidermis. They come into the market in cylindrical pieces of variable lengths, from a few inches to a foot and a half; sometimes singly, sometimes doubly quilled; from two lines to an inch in diameter; and from half a line to two or three lines in thickness. The finest kinds are about the size of a goose quill. Their exterior surface is usually more or less rough, marked with circular and longitudinal fissures, and of a grayish colour, owing to the lichens which cover the epidermis. The shade is different in different samples. Sometimes it is a light gray approaching to white, sometimes dull and brown, sometimes a grayish-fawn, and frequently diversified by the intermixture of the proper colour of the epidermis with that of the patches of lichens attached to it. The interior surface in the finer kinds is smooth and velvety; in the coarser it is occasionally rough, and somewhat ligneous. Its colour is uniformly a dull orange, sometimes inclining to red, sometimes to yellow; and in some

inferior specimens it is of a dusky hue. The product of the *C. lancifolia* of Bogota probably received the name of orange-coloured bark from the appearance of its inner surface.

The fracture is usually clear, with some short filaments on the internal part only. In the coarser barks it is more fibrous. The colour of the powder is a pale fawn, which is of a deeper hue in the inferior kinds. The taste is moderately bitter and somewhat astringent, without being disagreeable or nauseous. Some authors speak of an acidulous and aromatic flavour, which is perhaps sensible to very delicate palates. The superior kinds have a very feeble odour, which is distinct and agreeably aromatic in the powder and decoction.

The pale barks are chemically characterized by containing much tannin and cinchona, but little quinia. Their appearance indicates that they were derived from the smaller branches. They are collected in the provinces about Loxa, or in the country which surrounds the city of Huanuco to the N.E. of Lima, and are probably obtained chiefly from varieties of the *C. lancifolia*.

In this country, the pale barks are all known in commerce by the general name of *Loxa Bark*. The finest specimens are sometimes called *Crown Bark of Loxa*, a name also applied to them in England and Germany, and evidently derived from the impression that they have the same origin and character with the bark formerly selected with great care, for the use of the king of Spain, and the royal family. It is probable, however, that the best of all the different kinds were appropriated to the royal use; and the honour was certainly shared by the yellow with the pale. The extension of the term Loxa bark to all the different varieties, which belong to this class, is peculiar to the United States, and is not authorized by the facts of the case. They are not obtained exclusively from the province of Loxa, nor from the country bordering upon it. The French and Germans distribute them into at least two distinct divisions, originally named from the place of growth or export, but

depending at present upon peculiarity in properties without any geographical reference. One of these divisions has the title of Loxa bark, the other is called Lima bark by the French, and Huanuco bark by the Germans.

a. The proper *Loxa bark* is in cylindrical tubes strongly rolled, from twelve to eighteen inches long, varying in size from that of a small quill to that of the little finger, very thin and consequently light, and covered with an epidermis more or less rough, marked with transversal fissures, and of a grayish colour. The internal surface is smooth and uniform like that of cinnamon, and of a dull orange-yellow or reddish hue, which becomes brighter upon the application of moisture. The fracture is clear, or but slightly fibrous. Two subvarieties exist in this division, one with a light gray epidermis, called in French pharmacy *Quinquina gris de Loxa*; the other brown or of a dark gray externally, and from this circumstance named *Quinquina gris brun de Loxa*. Guibourt considers the former as identical with the *Cascarilla delgada*, or slender bark, of Spanish commerce. The finest specimens of Loxa bark are thought to be derived from the *C. Condaminea*, and to be the same with that of which Humboldt speaks as having acquired great repute under the name of *Cascarilla fina de Uritusinga*. Among the Loxa barks may be included the *Lagartijada*, or Lizard-coloured, of the South Americans. Much of the Loxa bark is said to be derived from the *C. scrobiculata* of Humboldt, considered by Lambert identical with the *C. purpurea* of the Peruvian Flora.

b. The *Lima bark* of the French, or *Huanuco* of the Germans and Spaniards, was introduced into notice about the year 1779, after the discovery of the Cinchona trees in the central region of Peru. The first name originated from the circumstance that the bark entered into commerce through the city of Lima; the second was derived from the name of the city, in the more immediate neighbourhood of which the trees were found. The finer sort of Lima bark is scarcely distinguishable in description from that of Loxa. The French

call it *Quinquina gris fin de Lima*. The coarser kinds are more strongly marked. The size varies from that of the little finger, to that of the thumb. Their external surface is rough, with transverse fissures closely arranged, and an epidermis which, though sometimes thin and adherent, is frequently thick and spongy, and easily separable in small scales, which leave numerous circular impressions. The bark is thick, and breaks with a fracture which is close on the exterior, but woody or fibrous on the interior. The internal surface is yellowish or reddish, and rougher or more ligneous than that of the Loxa bark. The French call this sub-variety *Quinquina gros de Lima*, and when the epidermis is white, as it sometimes is from the presence of chalky cryptogamous plants, they call it *Lima blanc*. Under this head of Lima barks, are included by some authors the *Cascarilla ferruginea* or ferruginous bark of the Spaniards, so named from the tawny ochreous appearance of its epidermis; and the variety called *Havannah* bark, distinguished by its gray epidermis with a reddish or rosy tint. In the same class are also placed by M. Laubert the *Cascarilla bobo de Hojas Moradas* of the Peruvians, derived from the *C. purpurea*, and the *Leonado obscura*, distinguished by the tawny colour both of the epidermis and cortical layers.* These latter varieties, however, are little known, and not highly esteemed. It is probable that most of the Lima or Huanuco barks are derived from varieties of the *C. lancifolia*, the *C. hirsuta*, and the *C. purpurea*. They are generally considered inferior to those of Loxa, and their somewhat less bitter and more nauseous taste would seem to justify this opinion.

In the above account, the different varieties of pale bark, with their several commercial names, have, perhaps, been more particularly noticed, than is requisite for the ordinary purposes of pharmacy: but the student will find an advantage, when perusing works on the subject of this important

* *Cascarilla bobo de Hojas Moradas* signifies Mulberry-leaved booby-bark, and is said to have derived a portion of its name from an idea that it is better than it looks. *Leonado obscura* signifies dull lion-coloured.

drug, in being able to understand the distinctions referred to by authors, and the terms familiarly employed by them, even though he should not thereby be rendered more competent to judge of the qualities or practical application of the medicine. In this country, the pale bark appears to be falling into disuse; and the sales made by the druggists have, I am informed, been much diminished. As it yields very little quinia, it is not employed in the manufacture of the sulphate of this alkali, which has almost superseded the bark as a remedy in intermittents; and the red bark is preferred by physicians, when it is necessary to resort to the medicine in substance. There is little doubt, however, that *cinchonia* possesses febrifuge properties, little if at all inferior to those of *Quinia*; and should the source of the latter begin to fail, the pale bark would come into more extensive use for the preparation of the former.

2. *Yellow Bark.*

The official term yellow bark should be considered as applicable only to the valuable varieties of the drug having this colour. These are all grouped together in commerce under the name of *Calisaya*, said to be derived from a district of country in Bolivia near the city of La Paz, where this variety of bark is collected. The name was afterwards extended to the produce of other and distant provinces, and is now applied to all the barks possessing the properties about to be detailed. Among the druggists they are arranged in two divisions, the quilled and the flat, which sometimes come mixed together in the same seroons, sometimes separate. The appearance of both indicates that they were taken from larger and older branches than those which yield the pale varieties. They are sometimes called by the French *Quinquina Jaune Royal*, from their resemblance to a variety of bark formerly selected for the Spanish king.

The *quilled Calisaya*, *C. Arrolada* of the Spanish Americans, is in pieces from three or four inches to a foot and a half long, from a quarter of an inch to two or three inches in diameter, and of equally variable thickness. The epider-

mis is of a brownish colour, diversified by lichens, is marked by transverse fissures, and is often partially separated, and generally easily separable from the proper bark. In the large kinds it is thick, rough, deeply indented by the transverse fissures, and composed of several layers separated from each other by a reddish brown membrane like velvet. This epidermis yields a dark red powder, is tasteless, and possesses none of the virtues of the bark. It is desirable, therefore, to get rid of it before the bark is powdered, as the medicine is thus procured of greater strength. The bark itself without the epidermis is from one to two lines in thickness; of a fibrous texture; and when broken, presents shining points, apparently the termination of small fibres running longitudinally, which, examined by the microscope, are found, when freed from a salmon-coloured powder that surrounds them, to be yellow and transparent. They readily separate, when the bark is powdered, in the form of spicula, which like those of Cowhage insinuate themselves into the skin, and produce a disagreeable itching and irritation. The colour of the bark is yellow, with a tinge of orange, the taste less astringent than that of the pale bark, but much more bitter and more nauseous. The external cortical layers are more bitter and astringent, and consequently stronger in medicinal power than the internal, probably from the longer exposure of the latter to the action of air and moisture. The odour is faint, but, when the bark is boiled, resembles that of the pale varieties.

The *flat Calisaya*, *C. Plancha*, which appears to have been derived from the large branches and trunk, is in pieces of various lengths, either quite flat, or but slightly curved, generally destitute of the epidermis, and therefore presenting the yellow colour of the bark both within and without. It is usually thicker than the quilled, more fibrous in its texture, less compact, less bitter, and possessed of less medicinal power. Sometimes portions of the sap-wood adhere to its internal surface, and increase its thickness. Though

weaker than the proper bark of the quills, it is usually, in equal weights more valuable than that variety, because free from the useless epidermis.

Along with the varieties above described, others are sometimes enumerated, especially one denominated by Guibourt, and after him by other French writers, *quinquina jaune orangé*, or orange-yellow bark, distinguished by its more compact texture, and its well marked orange colour.

All the valuable yellow barks are characterized by their strongly bitter taste, with comparatively little astringency; by their fine yellow, somewhat orange colour, which is still brighter in the powder; and by containing a large proportion of *quinia* with very little *cinchonia*. The salts of quinia and lime are so abundant in their composition, that their infusion instantly precipitates a solution of sulphate of soda.

Authors are by no means agreed as to the particular species which yields Calisaya bark. Some, influenced simply by its officinal title of *yellow bark*, have attributed it to the *C. cordifolia*, because Mutis gave the same name to the product of this species. The British colleges have fallen into the error, without, however, being aware that the yellow bark which they adopted as officinal was really the *Calisaya*. That it is an error has been fully demonstrated, as no *Calisaya bark* is brought from those regions where the *C. cordifolia* most abounds. Many writers ascribe this variety to the *C. lancifolia*, or the authority of Mutis himself, who asserts that it is indisputably derived from that species. This may possibly be the case; and the supposition of M. Guibourt may be true, that the officinal pale, yellow, and red barks are all derived from varieties of the *C. lancifolia*: but we have no precise information on the subject; and Ruiz himself acknowledges that he is unacquainted with its source. A curious mistake on this subject is made by A. T. Thomson in his dispensatory. Considering the *C. lancifolia* as undoubtedly the origin of the *pale bark*,

and at the same time receiving without hesitation the assertion of Mutis that the Calisaya is the product of this species, he has inferred that the two must be identical; and has therefore given *Calisaya* as one of the synonymes of *pale bark*; while he has accurately described the true Calisaya, but without naming it, under the head of *C. cordifolia* or yellow bark.

The genuine Calisaya bark is produced most abundantly in Bolivia, formerly Upper Peru, in the province of La Paz: and, before the disturbances in these quarters, was shipped as well from the port of Buenos Ayres, as from those on the Pacific. It is at present, however, procured exclusively from the latter. A very fine parcel recently came under my notice, imported directly from Coquimbo in Chili. It is generally supposed to have been first introduced into commerce towards the end of the last century, and it was probably not known by its present name till that period: but La Condamine states that the Jesuits of La Paz sent to Rome, at a period anterior to the discovery of the febrifuge of Loxa, a very bitter bark by the name of *Quinquina*; which, though supposed by that traveller to have been derived from the Peruvian Balsam tree, was very probably, as conjectured by Guibourt, the true Cinchona. Besides, Pomet in his *History of Drugs*, published in 1694, speaks of a bark more bitter than that of Loxa, obtained from the province of Potosi, which borders upon that of La Paz: and Chomel also states that the Cinchona tree grew in the mountains of Potosi, and produced a bark more esteemed than that which grew in the province of Quito. It is probable that, although known at this early period, it may have gone out of use; and its re-introduction into notice towards the end of the last century may have been mistaken for an original discovery. Whether it is found in the other localities of bark in Peru and Quito it is difficult to determine: but we may infer from the existence of a commercial variety known to the Spaniards by the

name of *Calisaya de Quito*, that either the identical bark, or a variety closely analogous to it, has been found in that province. The *Calisaya de Santa Fé*, mentioned by Laubert, has no other claim to the title given it than its colour: and it is not distinguished in the market, perhaps not distinguishable from the ordinary yellow Carthagena bark.

3. Red Bark.

The name of this variety is very appropriately applied, as the colour is usually distinct both in the bark and the powder. In South America it is called *Cascarilla Roxa* and *Colorada*. Some writers have divided it into several sub-varieties; but there does not seem to be ground for such division in any essential difference of properties. Like the *Calisaya* it comes in quills and flat pieces, which are probably derived from different parts of the same plant.

Some of the pieces are entirely rolled; some partially so, as if they had been taken from half the circumference of the branch; others are nearly or quite flat. They vary very much in size, the quill being sometimes less than half an inch in diameter, sometimes full two inches, while the flat pieces are occasionally very large and thick, as if derived from the trunk of a tree. They are usually covered with a reddish brown or gray epidermis, which is rugged, has cracks running in different directions, and is in some instances remarkable for numerous projecting points, which correspond with small prominences on the exterior surface of the proper bark. This last peculiarity is made by M. Guibourt the distinguishing character of one of his divisions of the red barks; "*Le quinquina rouge verruqueux*," or *warty red bark*; and another division in his classification is, from the absence of this appearance, entitled, "*Le quinquina rouge non verruqueux*." Beneath the epidermis is a layer, dark, red, brittle, and compact, which

possesses some bitterness and astringency, but much less than the interior parts. These are woody and fibrous, of a more or less lively red colour, which is usually very distinct, but in some specimens passes into the orange and even yellow, so that it is not always possible to distinguish the varieties by this property alone. The taste is bitter and astringent, and the odour similar to that of other good barks. The red bark is chemically distinguished by containing considerable quantities both of quinia and cinchona.

Till very recently it has been almost universally admitted, on the authority of Mutis, that this variety was the product of the *C. oblongifolia* of that author, and of the *C. magnifolia* of the Flora Peruviana, which is generally supposed to be the same species with the former. But it is now well understood that the *red bark of Santa Fé*, the real product of the *C. oblongifolia*, has little else in common with the true officinal red bark than its colour; and belongs properly to the Carthagena barks. This might have been conjectured from the fact, that none of the best red bark is brought from the Atlantic ports of Colombia, through which the product of the *C. oblongifolia* must, at least in part, be sent out of the country. But Burgen is the first author who has satisfactorily shown, that the genuine red bark of commerce was not derived from this species. The proofs advanced by him are the following. A specimen of the bark of the *C. oblongifolia* given by Humboldt to Schræder was found to be the *Quina nova* of commerce, and to bear no resemblance to the genuine red bark; and Humboldt acknowledged to this gentleman that he was unacquainted with the tree which yields the latter. Ruiz and Pavon also, though they frequently mention the red bark, agree in stating that they are ignorant of its source; and in the supplement to the *Quinologia*, mention that the red bark from the *C. oblongifolia* is wholly different from the commercial variety which bears that name.

Besides, in the collection belonging to Ruiz were specimens of the bark of the *C. oblongifolia*, designated by the name of *Quina azahar o roja de Santa Fe*, which were entirely different from the genuine red bark, while they bore an exact resemblance to the *Quina nova*. These arguments of Burgen are still further strengthened by the testimony of Guibourt, who states that a specimen of the red bark of Mutis, the product of his *C. oblongifolia*, which had been presented by this botanist to Humboldt, and by him deposited in the botanical cabinet of the *Jardin du Roi*, was found upon examination scarcely to differ from that known in commerce by the name of *Quina nova*. This *Quina nova* is an inferior kind of Carthagena bark, of a red colour, formerly supposed to be furnished by the *Portlandia grandiflora*, and containing little or none either of *quinia* or *cinchonia*. It appears, therefore, that the valuable red bark is not derived from the *C. oblongifolia*, and that nothing is certainly known of its source. There is some reason to believe that it may be derived from the same species with the pale barks, but taken from the larger branches or the trunk. This opinion receives some support from a statement made by La Condamine in his memoir upon the subject of the Cinchona. We are told by this author that three kinds of bark were known in the neighbourhood of Loxa, the white, the yellow, and the red. The white, so named from the colour of the epidermis, scarcely possessed any medicinal virtue, and was obtained from a tree entirely distinct from that which yielded the two other varieties. The red was superior to the yellow: but he was assured on the very best authority that the trees producing them grew together, and were not distinguishable by the eye. Of the three varieties mentioned by La Condamine, the white does not reach us from Quito, and that which he calls yellow is probably identical with the pale variety of the Pharmacopœia, as this grows most abundantly about Loxa, and before being powdered is often of a yel-

lowish colour. Should it be admitted that the red bark is furnished by the same tree which yields the pale, we have a ready explanation of the difference in size of the two varieties. The following are the words of La Condamine as extracted from his memoir by M. Guibourt in a paper published in the *Journal de Pharmacie*, April 1830. "My host of Cajanuma, who spends his life in the mountain in despoiling these trees, assured me of the fact, which I have since had confirmed by the best informed people, that between the yellow and the red there is no remarkable difference in the flower, in the leaf, in the fruit, nor even in the outer bark; that the eye cannot distinguish them by their external aspect; and that it is only by the introduction of the knife, that the yellow can be recognized by its lighter coloured and more tender bark. The two trees moreover grow side by side, and their bark is indifferently collected, though prejudice is in favour of the red. As to the white bark, the same individual assured me that the leaf was rounder, less shining than that of the others, and even somewhat rough; that the flower is also whiter, the grain coarser, and the bark externally whitish."

Carthagera Barks.

Under this head may be classed all the barks brought from the Atlantic ports of Columbia. Like those of Peru and Quito, they may be arranged in several subdivisions, characterized by peculiarities of colour. 1. The most abundant is the *yellow Carthagera bark*, which comes in fragments of various sizes, from one to three lines in thickness, usually covered wholly or in part with a whitish epidermis. The bark itself is of a yellow colour, spongy under the teeth, and of a bitter, nauseous taste. It is probably obtained from the *C. cordifolia*, as Guibourt found that a specimen of the bark of this tree, which came originally from Mutis, resembled it precisely in all its sensible properties. 2. Another variety may be called the *brown Carthagera bark*. This also has a white epidermis, which is smooth and with-

out fissures. The bark is hard, compact, very heavy, rough, and thick; of a chocolate colour internally; and of a bitter and astringent taste, more disagreeable than that of the pale barks, to which it is in other respects somewhat analogous. Its source is not known. 3. A third variety is the *red Carthagen bark*, readily distinguishable from the officinal red bark by its white, shining, almost micaceous epidermis. It is sometimes compact and bitter, sometimes spongy and with little taste. Guibourt gives the name of spongy Carthagen bark to the specimens presenting the latter character. It is probably derived from the *C. oblongifolia*, and is not much used in this country. 4. Within a few years a variety has appeared in our market under the name of *Santa Martha bark*, which ranks itself by its characters, with those of Carthagen. It derives its name from the port where it is shipped. It is either in small, irregular, oblong fragments, flat or but slightly curved, from one to three lines in thickness, usually destitute of epidermis, and presenting an appearance somewhat as if chipped from the large branches or trunk of the tree; or in short quills partially covered with a whitish epidermis, and evidently derived from the smaller branches. This bark is compact, of a pale yellowish colour, and a bitter, somewhat nauseous taste. It is usually considered superior to the ordinary Carthagen bark, probably from its greater bitterness. May it not be derived from the *C. macrocarpa*, the *C. ovalifolia* of Mutis, which Humboldt informs us grows in the neighbourhood of Santa Martha?

All the Carthagen barks, as will have been observed by the reader, have a white somewhat micaceous epidermis. They are also distinguished by a taste less bitter and more nauseous than that of the officinal varieties; and, though they contain more or less quinia or cinchonia, are by no means abundant in these principles.

ART. XIV.—On Borax.

[Compiled from Dumas by D. B. Smith.]

BORAX is composed according to the best authorities of

1 atom of soda,	32
2 atoms of acid,	48
8 atoms of water,	72
	<hr/>
	152

It crystallizes in a flattened hexahedral prism, terminated by a trihedral pyramid. Its specific gravity is 1.705. It effloresces, melts in its own water of crystallization, and at a red heat fuses into a limpid glass, which is true anhydrous borax, having a sp. gr. of 2.361.

Borax is found native in many places; in the island of Ceylon, southern Tartary, China, Transylvania, Persia, and in the environs of Halberstadt in Saxony. It also exists in large quantities in the mines of Viquintizoa and Escapa, in Peru. It is found abundantly in many lakes in India, whence the greater part used in commerce formerly came.

Turner places the lake from which they extract the Borax in India, at the distance of 15 days journey north of Teschoulounbou. It is found in large masses at the bottom near the shore. In the middle of the lake they only find the marine salt.

According to W. Blane and father Rovato, the lakes which furnish borax are situated in the mountains of Thibet; the most celebrated is called *Nubal* and is in the canton of Sumbul. The water is retained in pits which are drawn off at certain seasons of the year, and the salt is found crystallized at the bottom. These crystals are called tinckal; they are impure, yellowish and covered with an earthy coating, which is owing to a salty matter with which the salt is always combined.

Another variety of borax is brought from China, which has been partially purified. Both sorts require a second refining.

The most simple process for purifying borax is to reduce it into powder, and throw on a filter where it is washed with a solution of soda, of the strength of 5° Baumé. The operation which is performed, in order to deprive the borax of the fatty matter which envelopes it, is continued until the liquid passes off uncoloured. The remaining borax is then dried and dissolved in so much boiling water, that the solution shall mark 20° Baumé. A solution of twelve parts of carbonate of soda, for every one hundred parts of crude borax, is then poured in, and after the deposit caused by the soda has subsided, the liquor is filtered. The filtered liquid is then placed over the fire, and concentrated, till it marks 18° or 20°, and is then cooled in cones or quadrangular pyramids of sheet lead inverted, and having an interior doubling; if great care is taken in the process, large isolated crystals of borax, such as are most valued in the arts, will be obtained.

A new species of borax in octahedral crystals has lately been discovered, which is much superior for all practical purposes to the ordinary borax. It contains but half the quantity of water, its specific gravity is 1.815, its hardness is much greater than that of the prismatic borax, and the cohesion of its masses is so great that it can be cut into pieces of any size. In brazing, it swells up less; and flows more freely than the common borax and the value of equal bulks of the two varieties is as 70 to 53.

It is obtained by making a solution of common borax in boiling water, of the strength of 30° Baumé. This is left to cool very slowly, and the octahedral crystals begin to deposit at the temperature of 174°, and continue to form until it is reduced to 133°, after which prismatic crystals alone are obtained. M. Buran, who has prepared it for many years, makes a boiling solution of 1000 lbs. of Borax of 32°. He then covers the vessel so as to prolong the cooling, and at

the end of six days collects the products. These consist of a thick dense layer of octahedral borax, on the surface of which is a little prismatic borax that is easily separated. It appears that a prolonged ebullition is necessary to form the octahedral borax abundantly.

Of latter years the borax used in France has been prepared by M.M. Payen and Cartier from the boracic acid of Tuscany. They heat 125 gallons of water to the boiling point in a copper boiler of double that capacity; 1200 lbs. of crystallized carbonate of soda being then dissolved in it; the fire is covered so that the liquor may not boil, and 1000 lbs. of boracic acid are gradually added. When the saturation is finished, the vessel is carefully covered so as to keep in the caloric and left to repose for thirty hours. At the end of this time, the liquor is decanted in leaden vats for crystallization, which are filled to the depth of ten or twelve inches, and at the end of three days in winter and four days in summer the crystals are formed. These are purified by redissolving in boiling water, and adding ten per cent of crystallized carbonate of soda. The solution being concentrated till it marks 20° , is poured into pyramidal vessels to crystallize, and the mother liquor is decanted from the crystals when the temperature is reduced to 86° . It is advisable to operate on not less than 2000 lbs. of the salt at a time.

The existence of native boracic acid in the lagoons of Tuscany was discovered by Hocker and Mascagni in 1776. The soil of these lagoons is formed of a soft mud, which is incessantly agitated by the constant discharge of vapours from beneath. The noise of this disengagement is like that produced by steam in escaping through the safety valve of a steam engine, but is much louder and may be heard at the distance of half a league.

It has been attempted repeatedly to prevent the discharge of this vapour, in order to favour some labours necessary for the manufacture of the boracic acid; but although barrels filled with stones were forcibly driven into the holes through

which the vapour escaped; they were always after a few moments raised up and even projected to a great height in the air. This is the more remarkable as these holes are quite large and very numerous in a small space of ground.

The lagoons which are richest in boracic acid are those of Cherchiajo, Monte-Cerboli and Castelnuovo. The funnels of Castelnuovo, through which the vapour is discharged are situated at the bottom of a deep and narrow valley, and ranged in a line near its mouth. Those of Monte-Cerboli cover an extent of one hundred yards in length by fifty yards in width. These little craters are seldom situated on the sides of the hills:—in that case the vapour escapes through crevices of the rocks, in approaching which, a noise like that made by the pouring of water from a narrow necked bottle may be heard.

Most frequently they open at the bottom of a natural or artificial excavation filled with muddy water; and in passing through which the saline substances suspended by the vapour are condensed. These consist chiefly of boracic acid: hydrochloric acid and bitumen can be detected by the smell; and analysis proves the presence of the sulphates of iron, lime, magnesia, and ammonia. The sides of the fissures through which the vapours escape are moreover lined with crystals of sulphur.

The region in which these vapours rise is formed, according to Alexander Brongniart, of calcareous psammite, of common brown compact limestone, with beds of hornstone, marle and argillaceous schists; which proves that they had their origin below the lowest strata of alpine limestone.

The boracic acid is very easily obtained. The liquid mud amidst which the craters are situated is collected and washed with boiling water. These washings are decanted, and undergo a spontaneous evaporation in vessels placed on the ground, the heat of which is sufficient for the purpose.

In this manner three or four per cent of brown acid is ob-

tained, which is purified for commercial purposes by recrystallizing it.

Boracic acid may be obtained more cheaply and easily, from the island of Vulcano, the interior of the crater of which is lined with very pure white fibrous or scaly crystals of acid, to the thickness of about an inch.

Should the boracic acid be obtained from these great natural depositaries at a rate sufficiently cheap, it will hereafter become an article of immense consumption for the glazing of common earthenwares.

SELECTED ARTICLES.

ART. XV.—*On a process for preparing economically the Muriate of Morphia. By William Gregory, M.D. Fellow of the Royal College of Physicians, Edinburgh, and Lecturer on Chemistry.*

IN a note added by Wöhler to the last edition of Berzelius's *Lehrbuch*, several processes are given by Wittstock for the separation of morphia from narcotine, which is not completely effected by the ordinary process. One of the processes consists in treating the crystals of morphia, supposed to contain narcotine, by muriatic acid in slight excess, which dissolves both, and evaporating until a mass of feathery crystals of muriate of morphia is deposited. The crystals, when freed from the adhering liquid by pressure between folds of bibulous paper, are pure muriate of morphia; the muriate of narcotine being retained in the mother liquid. This process, founded on the fact that muriate of narcotine does not crystallize, I have found to answer very well; but the author directs it to be employed on the crystals of morphia, of course obtained from the alcoholic solution. It struck me that it might be applied to precipitated morphia, and that thus the use of alcohol, so expensive in this country might be avoided. As the muriate of morphia promised to be a salt useful in medicine, I endeavoured to find a method by which as large a quantity as possible might be extracted from opium *without the use of alcohol*. After many trials the following process appeared to answer my expectations.

Opium is cut in small pieces, and completely exhausted by cold water, or water at 90° F. The aqueous infusion is concentrated till it occupies a small bulk, and precipitated by a slight excess of ammonia. The precipitate is collected on a filter, washed moderately with cold water, and dried at a temperature below 212°. When dry, it is reduced to powder, and rubbed up with cold water. Diluted muriatic acid is now added by degrees. The first portions are speedily neutralized, but fresh acid is added until a slight but permanent excess is present. This dissolves both the morphia and narcotine, forming a dark-brown solution, which must be filtered to separate it from some very dark matter which is left undissolved. The filtered solution is now evaporated to nearly the consistence of syrup, and on cooling forms a brown mass of crystals moistened with a very dark liquid. The whole mass is now subjected to strong pressure between folds of bibulous paper, which absorbs the liquid containing the muriate of narcotine and colouring matter, and leaves the muriate of morphia tolerably pure, although still of a brownish colour. A second solution, crystallization, and expression, yields the salt nearly white and free from narcotine. By a third crystallization the muriate of morphia may be obtained in radiated bunches of silky crystals of snowy whiteness. These crystals, when dried by a moderate heat, become quite opaque. They are soluble to almost any extent in boiling water. Their solution has a very bitter taste, and yields, when supersaturated by ammonia, a highly crystalline precipitate of morphia. A similarly pure solution of narcotine in muriatic acid gives a curdy precipitate not at all crystalline.

The quantity of muriate of morphia obtained from opium by the above process varies according to the quality of the drug. From a very pure specimen of Mr Young's British opium I obtained 13.5 per cent of nearly pure salt in one of the first experiments I made. I have no doubt there was here considerable loss. On the other hand, from an equally pure specimen of East India opium, I obtained only 4.5

per cent. Here also I believe a good deal was lost*. The average amount I have hitherto obtained from good Turkey opium is from 10 to 11 per cent, quite pure. A great loss is sustained in the purification. Thus, in the experiments which yielded the above average quantity, the amount of the impure salt obtained by the first crystallization, which had only a fawn colour, was always from 13 to 15 per cent. From a beautiful specimen of Turkey opium, I even got 17.5 per cent of the impure salt. In all cases, the salt was dried by a heat of 150° F. until it ceased to lose weight, before its quantity was ascertained. In the repeated processes of expression, much muriate of morphia is absorbed by the paper along with the muriate of narcotine, and it may even be again recovered from the paper. I am at present engaged, along with my friend Dr Montgomery Robertson, in endeavouring to purify the muriate with a smaller loss, and we have good hopes of the result. But, taking the quantity of pure muriate obtained at 10 per cent, that is, about twelve drachms from the pound avoirdupois, this is incomparably the cheapest preparation of morphia having any pretensions to purity. The acetate used in this country, and the sulphate employed in France, are made, or should be made, by combining crystallized morphia with the acids. But, to obtain the morphia crystallized, a quantity of alcohol must be employed, which, in this country at least, enhances very much the expense of the preparation; and it is this expense which the above process will obviate, as no alcohol whatever is employed.

Since making the experiments which have led me to recommend the process here described, I have observed that MM. Henri and Plisson had previously published one in some respects similar, founded on the *insolubility* of narco-

* According to my experiments, and those also of Dr Christison, East India opium appears to contain little morphia, but abundance of narcotine. The very dark colour of this opium coincides with an observation I have frequently had occasion to make, that narcotine and the resinoid colouring matter of opium adhere very strongly together, and are often found associated.

tine in muriatic acid, when very much diluted. They advise that the opium be digested at a temperature between 90° and 104° in diluted muriatic acid,—that the infusion be precipitated with ammonia, and the mother-water acidulated, concentrated, and precipitated again with the same reagent;—that the impure morphia thus procured be next dissolved with successive portions of very dilute muriatic acid, till there is a faint excess, by which the narcotine is left, and the solution subsequently evaporated and crystallized;—that the muriate of morphia be lastly washed with a little water, and purified by animal charcoal and crystallization, successively repeated twice or thrice, according to circumstances. They then direct the morphia to be precipitated by ammonia from a solution of the pure muriate made with a faint excess of muriatic acid*. The peculiarities of the process I recommend, which give it in my opinion a considerable advantage over that now stated, are, that in the first instance water only is used for preparing the infusion, by which less of the resinoid matter is taken up, while all the morphia is dissolved; and that instead of purifying the muriate of morphia by washing and the repeated use of animal charcoal, both of which steps involve a considerable loss, and cannot entirely remove the narcotine, I accomplish the same end more economically, by simple expression and crystallization. To the loss sustained by repeated washing and digesting with charcoal, and not, as MM. Henri and Plisson imagine, to mere inferiority in the sample of opium they used, I am inclined to ascribe the small proportion of morphia procured by their process,—amounting, in fact, to no more than $6\frac{1}{2}$ per cent.

Not only is the acetate of morphia, the salt usually employed in this country, a very expensive preparation; it is also a very impure one in many cases. The strongest proof I can give of this is, that a quantity of acetate of morphia is said to be prepared in Glasgow, for the London market,

* *Journal de Pharmacie*, xiv. 252. 1828.

from the refuse or marc of laudanum. Now, when the laudanum has been properly prepared, I find that the marc contains no morphia, but a good deal of narcotine; and the French chemists are aware of this, so that they have recommended to extract the narcotine from the marc by means of acetic acid. Even if the opium used for laudanum be imperfectly exhausted, which is no doubt sometimes the case, any morphia which may remain in it must be strongly charged with narcotine, and hence unfit for internal use. It is impossible, except on the supposition of impurity, to account for the frequently unsatisfactory results, in this country, of the administration of remedies so well established abroad as the salts of morphia.

Lastly, the muriate of morphia seems to me to keep perfectly, whether dry or in solution.

At present, as the salt is only made by chemists on a small scale, its price may appear to some a sufficient reason for preferring the other preparations of opium, though less efficacious and salutary in their action. This objection, however, will be completely removed as soon as the chemical manufacturer shall prepare it on a large scale. The wholesale price of an avoirdupois pound of average opium,—which according to my experiments will yield an ounce and a half Troy of extremely pure muriate of morphia, and on a large scale, probably a drachm or two drachms more,—has been for the last two years, on an average, twenty-five shillings. If we add twenty-five per cent to this for expense of process and profit to the manufacturer, which is sufficient for an article that must cost very little in apparatus or materials, there will be procured an ounce and a half for thirty-one shillings and three pence; and this quantity makes, according to the experiments of Dr Christison and others, 2880 full doses.

Let us now compare the expense of this preparation with that of laudanum and the sedative solution of Battley. For Battley's solution the manufacturer charges the exorbitant wholesale price of twenty shillings per pound avoirdupois. Now, its medium dose, according to the experience of many

practitioners here, and especially that of the physicians of the Infirmary, being twenty-five minims, and its density almost exactly that of water,—a pound avoirdupois, that is 7000 Troy grains, or 7375 minims, will give only 295 doses. The expense of a dose of Battley's solution is therefore six times that of a dose of muriate of morphia.

By a similar calculation, it may be proved that the muriate of morphia will be even somewhat cheaper than common laudanum. To convert an avoirdupois pound of opium into laudanum, the Edinburgh Pharmacopœia directs it to be infused with twelve pounds of proof spirit, which is made with equal parts of water and alcohol of 835 density. Now the wholesale price of alcohol of this strength being in Scotland eleven shillings the gallon, and the gallon containing 8.35 avoirdupois pounds of such alcohol, the six pounds required to convert a pound opium into laudanum cost nine shillings and two pence. So that a pound of opium, made into laudanum by the Edinburgh process, costs the apothecary thirty-four shillings and two pence. The quantity of laudanum procured is about a twelfth less than the amount of proof spirit used, that is eleven pounds,—a portion being retained by the mass of opium, however well squeezed. As the density of the laudanum is 920, the eleven pounds will give 87087 minims. According to the experience of many professional friends here, a full dose of laudanum is at least thirty minims. Hence for thirty-four shillings and two pence there is procured 2903 doses.

Expressing these data in simpler terms, it appears that for twenty shillings the apothecary should receive 295 doses of Battley's solution, 1700 doses of laudanum, and 1840 of muriate of morphia. The muriate of morphia is at once, then, cheaper and more efficacious than any of the preparations of opium now in general use.—*Edin. Med. and Surg. Journ.* April 1831.

ART. XVI.—*On the Analysis of Elaterium, and its active principle. By John D. Morries, Esq. Member of the Royal Medical and Plinian Societies of Edinburgh.**

THE great uncertainty of the effects of Elaterium as a cathartic, and the probable dependence of this uncertainty on original differences in the quality of the drug, as well as on the occasional addition of impurities, render it an object of much consequence to determine what is its active principle, and how this may be separated in a pure state. Several attempts have already been made to attain this object,—among which it is only necessary for me to particularize the analysis of Dr Paris, first published in 1822. According to this analysis the active principle of elaterium, which he terms *Elatine*, is a green, soft, inflammable matter, free of bitterness, insoluble in water, and soluble in alcohol and the alkalies. The action of this substance as a medicine was so violent as strongly to favour the idea of its being the active principle. But a variety of circumstances tend to throw doubt over the accuracy and completeness of Dr Paris's analysis. Among these, it might be sufficient perhaps to observe, that he operated on so small a quantity as ten grains only of elaterium,—a quantity which could scarcely be expected to yield satisfactory results. But besides, in the physical and chemical characters of the substance procured by Dr Paris, the chemist must recognize a close resemblance to chlorophylle, and certainly no analogy with the active principles which have been discovered both before and since

* In some of the London weekly journals, published on the 12th February, the discovery of a crystalline principle in Elaterium has been announced as made by a Mr Hennell of the Apothecaries' Hall there. In reference to this announcement, we have authority for stating, that the principle discovered by Mr Morries, which is probably the same with that found by Mr Hennell, was put into the hands of Dr Christison early in November, and mentioned a day or two afterwards to various persons in Edinburgh. His paper was read before the Royal Medical Society on the evening of Friday the 4th of February.—*Editors of Ed. Med. and Surg. Journ.*

in almost every plant possessing an action on the animal body.

On repeating Dr Paris's experiments on the same quantity which he employed, I found results differing materially from his. Of ten grains of apparently good elaterium he found four soluble in water;* but on repeating this, I found that water only dissolved two grains and nine-tenths. Of the six grains insoluble in water, he found only five-tenths were dissolved by alcohol;† while I found that alcohol took up two grains and two-tenths.

These discrepancies of result must have arisen from the very great difference which prevails, as will presently appear, between various specimens of elaterium. But on proceeding with the analysis, I remarked other more important differences.

When fifty grains of good elaterium were digested for twenty-four hours in distilled water at a temperature of about 200° F. they were found to have lost eleven grains. The infusion was of a light brown colour, and an austere bitter taste, and appeared to contain a minute portion of gum, but no starch. On standing for some time, a few crystals of lime were deposited. The residual quantity, amounting to thirty-eight grains (one grain having been lost by adhesion to the filter, and other unavoidable circumstances), was acted on by alcohol, s. g. 825, and was found to have lost ten grains. The alcoholic tincture was of a deep green colour, and a bitter, somewhat acrid, taste. On being evaporated to the consistence of oil, and allowed to cool, numerous masses of small spicular crystals were observed; these were separated, washed with sulphuric ether, and dried. The rest of the extract was boiled in *aqua potassæ*, to free it from the elatine or colouring matter (terms I consider as synonymous), which is soluble in alkalies. After standing for a few minutes, a small quantity of white crystalline matter fell to the bottom of the flask. The supernatant fluid was now decanted, and the crystals collected on a filter, and

* Pharmacologia, p. 203. Exp. A.

† Ibidem, p. 204. Exp. D.

washed with sulphuric ether, to free them more completely from adhering colouring matter.

Having obtained an appreciable quantity of crystalline matter, I proceeded to examine its properties.

It is, as I have already stated, a white crystalline substance of an extremely bitter and rather styptic taste; insoluble in water and the alkalies; soluble in alcohol, ether, and in hot olive oil; sparingly soluble in dilute acids. When procured in a state of purity, as by the process to be described presently, it forms microscopic rhombic prisms, striated on the sides, possessed of considerable lustre, and of a silky appearance when in mass. It is decomposed by the strong acids, forming with nitric a transparent yellowish gummy-looking mass, and with sulphuric, a solution of a deep blood-red colour, which I should rather think caused by adhering colouring matter. It is fusible at a temperature a little above that of boiling water, and at a higher temperature is dissipated in thick whitish pungent vapour, having rather an ammoniacal odour.

Considering this substance as the proximate principle of *elaterium*, I first named it *elateria*; but as its alkaline reaction is not by any means distinct, and it does not appear to exist in the crude drug in the form of a salt, as every one of the acknowledged alkaloids does,—I have since altered it to *Elaterine*.

The process which I at first followed for procuring elaterine was that of washing the small crystals above-mentioned with sulphuric ether; this I found unmanageable, as the sulphuric ether dissolves both the elaterine and colouring matter with great facility.

The next process I tried was by boiling the alcoholic extract in *aqua potassæ*; this also I found inconvenient and troublesome. The process I now follow is simple and economical. The alcoholic tincture is to be evaporated to the consistence of thin oil, and while still warm, is to be thrown into boiling distilled water; immediately a copious white crystalline precipitate falls, and increases in quantity as the liquor cools. This precipitate is the elaterine, the elatine

remaining in solution. The elaterine is then to be separated by decantation and filtration, and repeatedly washed with distilled water. In this state it is sufficiently pure for ordinary purposes and for medical use. If it be required perfectly pure, it is only necessary to repeat the solution in alcohol and precipitation.

I would propose the same process for all vegetable crystallizable principles insoluble in water, as the separation from colouring matter is more complete after one precipitation than after repeated crystallization from alcohol in the ordinary method. I have tried it with strychnia, and found it completely successful. When cold water is used, the crystals are smaller, and do not possess lustre.

The following table gives a view of the different solubility of different specimens of elaterium, first in water, and then in alcohol, and of the quantity of elaterine contained in each:—

Grs.	British Elaterium.	Soluble in water.	Soluble in alcohol.	Quantity of Elaterine.
200	No. 1,	53	44	30
	2,	50	43	Not estimated.
	3,	44	46	40
	4,	46	45	36
	5,	52	63	52

Grs. French Elaterium.

200	light colour.	94	17	Not correctly estimated.
	dark colour.	140	20	

The best specimen of the British elaterium contained nearly 26 per cent of elaterine, and the worst, No. 1. about 15. The French elaterium, which I obtained through the kindness of Dr Duncan, did not appear to contain above 5 or 6 per cent. There is obviously, therefore, an extreme difference in the strength of this drug in its crude state; so that it ought never to be administered in that form, especially considering that its active principle may be procured by so simple a process.—*Edin. Med. and Surg. Journ.* Ap. 1831.

ART. XVII.—*On Oxamide, a substance which approximates to some animal Bodies.*—(M. Dumas.)

THIS substance is produced whenever oxalate of ammonia is distilled, and the name *oxamide*, or *oxalamide*, is given to it provisionally, as indicating that it is formed of oxalic acid and ammonia, and by particular treatment can reproduce these bodies. When acted upon by potash, it yields 36 per cent of ammonia, though it contains none: by the same treatment it can produce 82 per cent of oxalic acid, and yet includes none of that body. These curious properties associate oxamide with the phenomena which occur when animal substances are made to yield ammonia by the action of alkalies, and also with those new observations due to MM. Vauquelin and Gay Lussac, on the developement of oxalic acid, when organic matters are acted upon by potassa.

When oxalate of ammonia is distilled, it first loses water; the crystals become opaque; then, where close to the heat, fuse, boil, are decomposed, and disappear without any change occurring in the more distant parts of the mass. Ultimately, a little carbon remains, but nearly the whole has been volatilized. The water which has passed over into the receiver contains a flocculent substance; a thick deposit of a dull white matter also lines the neck of the retort; both these are oxamide. To isolate it, the whole is diffused in water, filtered and washed, the peculiar substance remains in the filter, 100 parts of the oxalate of ammonia yield 4 or 5 of oxamide; the other products are ammonia, water, carbonate of ammonia, carbonic acid, oxide of carbon, and cyanogen.

Oxamide occurs in imperfectly crystallized plates, or as a granulated powder. When well washed and pulverized, it is a dirty white powder, looking like uric acid, having no taste or odour, and not affecting test papers. Heated carefully in an open tube, it volatilizes; heated in a retort, part sublimes, whilst part is decomposed, yielding cyanogen and

a very bulky, light charcoal remains. It is scarcely soluble at common temperatures; a saturated solution at 212° F. deposits confused crystalline flocculi of the unaltered substance.

As oxamide is an azoted substance, the ratio of the azote and carbon to each other was first ascertained by combustion with oxide of copper in a glass tube. In this mode of analysis, M. Dumas points out the necessity of collecting the *whole* of the gas evolved, and ascertaining its composition. Portions of the gas often differ from each other; and if the composition of the whole be deduced from these portions, great errors may occur. In experiments on the oxamide, two volumes of carbonic acid were produced for each one of azote, so that the carbon and the azote are in the same proportion as in cyanogen; 100 parts of oxamide gave 26.95 carbon, and 31.67 azote.

When oxamide was heated with great excess of concentrated sulphuric acid, it yielded a mixture of carbonic acid and of carbonic oxide gases in exactly equal volumes; no cyanogen was formed: this is precisely what takes place with oxalic acid. When the sulphuric acid was diluted and saturated with potash, much ammonia was evolved, so that a sulphate of ammonia had been formed. In this way, therefore, oxamide is resolved into ammonia, carbonic oxide, and carbonic acid.

When oxamide was heated for some time with strong solution of potassa in great excess, much ammonia was disengaged. The potash, afterwards neutralized by nitric acid, was found to contain oxalate of potassa, so that potassa evolves oxalic acid and ammonia from oxamide, and those substances only.

These results created a suspicion, that oxamide was to oxalate of ammonia what pyrophosphoric acid is to the ordinary phosphoric acid. The substance, therefore, was compared to oxalate of ammonia, supposed to be dry, both by theory and experiment. The carbon is to the azote as 2 proportionals to 1 in both compounds; but 100 parts of oxa-

oxide contain 26.95 of carbon, and 31.67 of azote, whilst 100 parts of dry oxalate of ammonia contain only 22.6 of carbon, and 26.6 of azote. When 100 parts of oxamide were converted by potash and sulphuric acid into the elements of oxalate of ammonia, they gave products amounting to 120 parts, i. e., 26.95 carbon, 31.67 azote, 54.70 oxygen, and 6.3 hydrogen = 119.62. Now, the sulphuric acid and the potash could neither of them give carbon or nitrogen, but might communicate oxygen and hydrogen from the water present with them: withdrawing 19.62 of these elements in the proportion to form water, there remains the following composition as nearly as may be :—

4 vols. carbon	27.08
2 — azote	32.02
2 — oxygen	36.36
4 — hydrogen	4.54
	<hr/>
	100.

Oxamide may, therefore, be considered at pleasure as a compound of cyanogen and water; or as a compound of deutoxide of azote, and bicarburetted hydrogen; or as a compound of oxide of carbon and a hydruet of azote, different to ammonia. Whichever way it be viewed, if 2 volumes of vapour of water are added to it, dry oxalate of ammonia is produced; and it is in this way, apparently, that sulphuric acid and potassa act.

In conclusion M. Dulong remarks, that many animal matters, as albumen, gelatine, fibrine, &c., act with potassa as oxamide does. Uric acid approximates to it : hippuric acid also resembles it. All these bodies have properties in common with it so characteristic, that M. Dulong has been induced to commence an experimental comparison of them with this new substance.*—*Journ. Royal Instit.* Feb. 1831.

* *Ann. de Chimie*, xliv. 113.

ART. XVIII.—On the Distillation of Nitric Acid. By E. Mitscherlich.

DURING the decomposition of nitre by sulphuric acid, there are some circumstances regarding the combination of the acid with the potash of the nitre, which have hitherto been but little attended to. Of the three compounds of sulphuric acid and potash with which we are acquainted, the sulphate and bisulphate only require our consideration with respect to the above process, the former of which is sufficiently known; the bisulphate contains twice as much acid as the sulphate; and water, the oxygen of which is to that of the acid as one to six; this water is very fixed, and is not even evolved during the fusion of the salt at 392° F., but only when the salt itself is decomposed; a property which the latter has in common with the sulphate of the protoxide of iron, and some other salts. It would accordingly, perhaps, be better to consider the bisulphate of potash as a compound of the hydrate of sulphuric acid and the sulphate of potash: it consists of 58.80 sulphuric acid, 34.61 potash, and 6.59 water.

If equal parts of the nitrate and the bisulphate of potash be distilled with half a part of water, until the emission of red vapours begins, which is the case at about 418° F., the water in the receiver will be found to contain not more than $1\frac{1}{2}$ per cent acid of the nitrate employed; and it accordingly is evident that the bisulphate and the nitrate commence only to act on each other at that temperature. On increasing the heat; the retort becomes filled with red vapours; oxygen is evolved and nitrous acid distills over, and is dissolved by the aqueous nitric acid in the receiver. The emission of red vapours continues when the retort is red hot, and it appears consequently, that even at so high a temperature a large quantity of the nitrate is left undecomposed by the bisulphate.

If the quantity of sulphuric acid employed be just sufficient to produce the sulphate, the temperature required for

the distillation of the acid does not exceed 302° F.; after half the quantity of the acid in the nitrate has been distilled over, the residue consists of bisulphate and nitrate of potash which, on increasing the temperature, act on each other in the manner above described—viz., oxygen and nitrous vapours are evolved and the liquid in the receiver is coloured by nitrous acid. The quantity of water employed in the process is quite indifferent, and influences only the strength of the distilled acid, which, previous to increasing the heat above 302° F., is perfectly colourless. According to this process, that is to say, where the quantity of sulphuric acid is 48.41 to 100 of the nitrate, the quantity of nitric acid produced does not exceed six-sevenths of that previously contained in the nitrate.

Nearly the same result is obtained by distilling 100 parts of nitre with 72.6 of sulphuric acid; but in this, as well as in the last process, a very great heat is required to decompose the last proportions of nitre, part of the acid of which will, moreover, also be found to be lost. But if, with 100 parts of nitre, 96.8 parts of acid are used, so that the bisulphate of potash is formed, the process will be found to be far more profitable, for none of the acid is lost; distillation takes place very easily, and at a heat not exceeding 248° to 257° F.; the nitric acid obtained is of 1.512 gravity, which by distillation may be increased to 1.54. The former which is colourless contains 86.17; the latter is rather yellowish, and holds 88.82 per cent of acid.

If water is added to the acid of 1.522, the boiling point of the liquid gradually rises; and, on distillation, first concentrated and then weak acid will be found to pass over. This continues, however, only until the quantity of water amounts to 44 per cent of the acid, the specific gravity of which is then 1.40, and the boiling degree between 248° and 249° F.; if the quantity of water is still increased, the boiling point falls, and the order of the distillation is, as it were, contrary to what it was observed before—viz., first weak and then strong acid is obtained. This likewise takes place during the distillation of nitric acid from nitre; for if, with 100 parts of nitre and 96.8 of sulphuric acid, the quantity of water is

not equal to 44 per cent of the acid formed, the first produce of distillation is strong, and the next diluted acid; if more water is employed, the contrary takes place.

It is, accordingly, most advantageous to use 100 parts of nitre, 96.8 of sulphuric acid, and about 40.45 of water, which will be sufficient, as the nitrate of potash always contains some water; and the sulphuric acid is seldom so concentrated as to contain less than $18\frac{1}{2}$ per cent. The acid distils at 266° F., and its specific gravity is between 1.4 and 1.395. 28 lbs. of purified nitre, with $13\frac{9}{10}$ lbs. of sulphuric acid, of 1.85, yielded 34 lbs. of nitric acid, of 1.30 specific gravity; and the same quantity of nitre, with $27\frac{1}{8}$ lbs. sulphuric acid, gave $37\frac{7}{8}$ lbs. of nitric acid, of 1.30*. Besides, the first process required almost twice as much fuel and much more time than the second.

In conclusion, M. Mitscherlich mentions some remarkable properties of nitric acid, of 1.522 specific gravity. Iron, tin, and several other metals, may be put into, and even boiled in it, without the least effect; whilst zinc is immediately oxidized and dissolved.†—*Journ. Royal Instit.* Feb. 1831.

ART. XIX.—*On the Volatility of Oxalic Acid.* By Edward Turner, M.D. F.R.S. L., & E., Sec. G.S. Professor of Chemistry in the University of London.

THE object of this notice is to communicate a few facts respecting the volatility of oxalic acid. It is stated in chemical works, that when this acid is exposed to the destruc-

* According to Thénard, from 100 parts of nitre and 66 2-3 of sulphuric acid, 43.8 of very strong nitric acid, and from the same quantity of nitre with 144 parts of sulphuric acid, 81.6 parts of nitric acid of the same strength were obtained. These results appear to M. Mitscherlich to be erroneous.

† Poggendorff's Annalen.

tive distillation, part escapes decomposition and is sublimed, being deposited as a white sublimate in the neck of the retort; but whether this appearance is owing to real volatility, or is an instance of that spurious kind of sublimation, exemplified in the ascent of boracic acid along with aqueous vapour, and in the removal of fused chloride of silver when a current of hydrogen gas is passing rather rapidly over its surface, does not seem to have been fully determined. Oxalic acid, in consequence, is not generally regarded as volatile, except at a temperature sufficiently high for producing its decomposition.

Having been accidentally led to investigate this point, I found that oxalic acid may be sublimed at a very moderate temperature, even so low as 212° Fahr., without undergoing any chemical change, except that the common crystals lose two-thirds, corresponding to two equivalents, of their water of crystallization. When 63 parts of the common crystals are placed in a water-bath, efflorescence rapidly ensues, and 17.31 parts, somewhat less than two equivalents, of water are expelled. If the effloresced mass is then removed from the fire and exposed to the air, it speedily recovers from the atmosphere precisely the quantity of water which it had lost; but if it be still kept in the water-bath, the surface of the acid, instead of remaining pulverulent, becomes covered with numerous minute acicular crystals, and an acrid vapour rises, which condenses on cold surfaces in the form of needles. This vapour is accompanied with a small quantity of moisture, which completes the two equivalents of water required to be withdrawn, in order to constitute the sublimed acid.

The sublimation of oxalic acid at 212° , though sufficient both to occasion loss in analysis, and to establish the fact of volatility, is too slow for affording a supply of the sublimed acid. A convenient process for this purpose is the following: About half an ounce or an ounce of oxalic acid, purified by repeated crystallization, is dried in a rather deep evaporating basin, exposed on the sand-bath to a temperature

of about 350° or 400° Fahr.: as soon as sublimation commences, the vessel should be covered with a layer of smooth filtering paper, on which is laid a fold of common blotting-paper, and both are pressed tight upon the edge of the basin by means of another and somewhat larger capsule, placed with its convexity downwards, and containing cold water or ice. During this rapid sublimation some of the acid is decomposed, and the water derived from this source is absorbed by the coarse outer fold of paper; while the acid is condensed on the smooth paper below, and gradually falls down upon the sides of the dish. At intervals of about an hour the apparatus should be removed from the fire, and the sublimed portions, while still warm, be brushed away with a feather, and quickly secured in a well-stopped bottle.

Sublimed oxalic acid, as thus procured, is commonly in the form of minute shining acicular crystals; but I have occasionally obtained it in slender prisms half an inch long, possessed of considerable lustre and transparency. On exposure to the air it becomes dull and opaque from the absorption of moisture, 45 parts or one equivalent of the sublimed acid rapidly acquiring two equivalents of water, and thus regaining its original constitution. This water is again completely expelled by a temperature of 212° . The vapour of the acid is very pungent, exciting cough and sneezing more readily than the fumes of nitric or muriatic acid.

Sublimed oxalic acid rises slowly, as already mentioned, at 212° . As the temperature increases, the sublimation becomes more rapid; and if the heat does not exceed 300° or 330° , the acid sublimes entirely without decomposition. At 360° the sublimation is very free; between this point and 400° it sublimes rapidly; and at 414° it fuses and enters into brisk ebullition. At temperatures exceeding 330° more or less of the subliming acid, as the heat is more or less intense, suffers decomposition; a change immediately indicated by the appearance of water.

The facts already mentioned leave little doubt of sublimed

oxalic acid consisting of 36 parts or one equivalent of the anhydrous acid, and 9 parts or an equivalent of water. The correctness of this opinion was proved by analysis, the oxalic acid being precipitated with lime, and its quantity inferred in the usual manner by decomposing the resulting oxalate of lime. The sublimed acid, also, is readily decomposed by concentrated sulphuric acid, yielding abundance of gas, which consists of exactly equal measures of carbonic oxide and carbonic acid. When neutralized with potash and ammonia it yields crystals similar to the well-known oxalates of those alkalies; and the crystals, obtained from a solution of the sublimed acid in pure water, were measured by Mr Miller of St John's College, Cambridge, and found identical with the crystals of the common acid. These facts leave no doubt concerning the nature and constitution of the sublimed acid.

Before concluding this notice, I may add a few remarks on the solubility of ordinary oxalic acid in water, concerning which the statements of different authors are very discordant. The solvent power of water increases rapidly with the temperature. A hot solution of oxalic acid was set aside for twenty-four hours, when the clear liquid, kept at the temperature of 50° Fahr., was decanted from the crystals which had been deposited. This solution consisted of one part of crystallized acid and about 15.5 of water. The experiment was repeated by putting the pulverized crystals into water at 50° , agitating repeatedly during twenty-four hours, and then decanting the solution from the undissolved acid. The ratio of the ingredients was almost exactly the same as that above stated. Similar observations were made with water at 57° Fahr., of which 9.5 parts dissolve one of the crystallized acid.

Crystallized oxalic acid dissolves in almost an unlimited quantity in water kept at 212° by immersion in boiling water. If the acid solution is kept boiling by the direct application of fire, the temperature rises considerably above 212° , and the quantity of the crystallized acid dissolved is

then unlimited. This is not surprising; since the crystals fuse in their water of crystallization at about 220° Fahr.

I may also add the following observations on the degree of permanence of crystallized oxalic acid. When the crystals are kept for some hours under a bell-jar, with quicklime, at a temperature not higher than 50° or 55°, they contain all their water of crystallization, consisting of one equivalent of real oxalic acid and three equivalents of water. If then exposed to a damp air, they increase slightly in weight by absorbing water hygrometrically, and its extent varies with the humidity of the atmosphere. In dry air at 70° Fahr. the crystals lose some of their water of crystallization, and effloresce on the surface. The efflorescing temperature is thus very little above the ordinary heat of summer.—*Philos. Mag. &c. March 1831.*

ART. XX.—*Method of obtaining Volatile Oils in Organic Analysis. By M. Bonastre.*

THE difficulty of obtaining certain volatile oils, which are met with in very small quantities in organic substances, submitted to analysis, is one of the principal causes, why these products are not always detected in articles in which they naturally exist. This difficulty is still greater, when substances such as the gum resins, &c. which independent of tenacious resin, also contain gummy albuminous or extractive matters, and are susceptible of thickening or even coagulating by the action of water and heat. In this latter case, it is absolutely impossible to obtain the volatile oil by the usual plan.

The result of this condition of things is very unsatisfactory.

1. From not being able to detect the new product, where it

really exists; and 2. The erroneous explanation it gives of certain chemical phenomena, which are liable to be attributed to other components.

Having occasion in 1829 to institute a comparative analysis of true myrrh, and of a new species which I term false, I soon perceived that the only *chemical* difference that existed between them was, that the first became of a rose, red and claret colour on the addition of nitric acid, which change did not take place in the second. Guided by my first experiments on the colouring of volatile oils by nitric acid, I thought that this change in the myrrh could only have arisen from the action of the acid on one of its special principles, and that this principle must be a volatile oil in the true myrrh.

In submitting the new species of myrrh to an analysis, I was struck with the extreme difficulty that I experienced in abstracting the volatile oil, and which I was only able to effect in a very imperfect manner.

Convinced that this difficulty was owing to the kind of gum contained in the myrrh, which swells considerably by the action of water and heat, I thought that I might arrive at more certain results by adopting an opposite procedure.

For this purpose, I procured eight ounces of true myrrh, in a single piece, that there might be no admixture. I reduced it to very small fragments, and introduced it into a matrass with an equal proportion of rectified alcohol. I shook this mixture often to aid the solution and decanted it at the end of six days. To the residue I added an equal quantity of alcohol and again decanted it in ten days. Finally, after a third addition of six ounces of alcohol and six days of maceration, I united the three tinctures, filtered them, and poured them into a tubulated retort.

I kept the retort in my hand for some time, the heat of which was sufficient to occasion the extrication of some alcoholic vapour, which condensed in the neck of the retort. I received the condensed fluid in a receiver full of water, and

was not a little surprised to find the water become turbid and milky. There was hence no doubt, that the alcohol was charged with volatile oil. I placed a thermometer in my hand; and found that the volatilization of the alcohol took place at 86° and its condensation at $53\frac{1}{2}^{\circ}$ only.

I thought that a heat of 86° was too great, since the volatilization of the alcohol, charged with volatile oil, had immediately taken place; I therefore endeavoured to diminish it, and left the tincture to evaporate slowly by the action of the air, in a tubulated retort with the stopper withdrawn. This operation lasted ninety-five days, during which the temperature was never less than $53\frac{1}{2}^{\circ}$ above 0, and never exceeded $67\frac{3}{4}^{\circ}$. After this time the alcohol was entirely evaporated and the residue was reduced to a blackish resinous mass of the consistence of Briancon turpentine. I then poured a sufficient quantity of water into the retort, and twelve hours afterwards carefully distilled it. The first vapour that condensed was much charged with volatile oil, which ran down into the recipient in the form of small globules, and floated on the surface of the water. I thus obtained all the volatile oil contained in the true myrrh. The residue formed a dry, friable resin, and a thick, compact extractive matter, very difficult to remove from the retort after cooling. The volatile oil of myrrh is fluid, lighter than water, of a light-amber colour, of a bitter and very acrid taste, and having a strong smell of myrrh. I obtained about eighteen to twenty drops: my principal object, however, is to prove the possibility of abstracting volatile oils contained in the soluble resins which form a constituent part of the gum-resins; for it is exceedingly probable that it is only in fluid resins of this kind that volatile oils naturally exist.

It is very likely that many other volatile oils may be obtained by this procedure. Thus senna, opium, rhubarb, jalap and other substances which are characterized by peculiar odours, owe these perhaps to volatile oils analogous to those of myrrh, but intimately mixed with various organic

products, from which they must necessarily be separated before proceeding to extract them by distillation.

From the above it may be concluded that the success of this plan of procedure consists,

1. In dissolving, by means of cold alcohol, the soluble principles supposed to contain the volatile oil.

2. In gently evaporating the alcohol charged with those principles at a low temperature.

3. In pouring pure water on the residue or liquid resin, and distilling the whole with caution in a retort.—*Journal de Pharmacie.* Feb. 1831.

ART. XXI.—*Sulphuric Ether.*

THIS substance is prepared in the royal laboratory at Berlin in the following manner.

11. kil. 710 sulphuric acid and 6 kil. of alcohol (0.835) are to be mixed together, and poured into a tubulated retort of about a foot in diameter. In the tube is to be fixed a glass tube bent at a right angle; the shortest leg of this tube is to enter the retort, and to reach about an inch below the surface of the fluid. To the other end, which should be about two to three feet long, is to be attached a tin tube from four to six inches long, which is to be furnished with a stop-cock. This tube is to be adapted by means of a perforated cork to a flask containing alcohol, which at a later part of the process is to reach the retort. It is better to cut the glass tube near the angle and to join the two pieces by means of a gum elastic tube, this renders it more manageable and less liable to accidents. The retort is now to be placed in a sand-bath, and covered as high as the fluid reaches, and a Gedda's small condenser or common worm surrounded by cold water adapted to it. The only part to

be luted is where the neck of the retort joins the condenser or worm. The liquid is now to be heated to ebullition, and by opening the stop-cock, a quantity of alcohol equal to the impure ether which distils over is to be permitted to run into the retort; in order that there may be no variation in the volume of the fluid in the retort, its height is to be marked by a band of paper, &c. The addition of the alcohol is to be continued, till 52 kil. have been employed, or about five times as much as the sulphuric acid.

A larger quantity would weaken the acid too much. This process lasts about 18 to 20 hours, and the operator is never subjected to any accident. When properly conducted it will afford 62.5 pounds of ether to the 100 of alcohol.

At the commencement of the distillation, water and ether pass over; at a later part of the process, however, where the acid is weakened this double product is not formed. The impure ether is a mixture of ether, alcohol, water, sulphurous acid, acetic acid, and oil of wine, and is to be rectified in a copper still, having been previously mixed with an equal bulk of water, and a small quantity of whiting or calcined magnesia. When the ether which passes over has a sp. g. of 0.72, it is almost certain that it contains no oil of wine; about one third of pure ether is obtained by this rectification, after which the impure ether comes over, then the alcohol containing much oil of wine, and lastly the water also mixed with oil of wine. These products are again to be submitted to distillation.—*Journal de Pharmacie*. Feb. 1831.

ART. XXII.—*Effects of Animal Charcoal on Solutions.*
By Thomas Graham, A.M., F.R.S.E., Lecturer on Chemistry, Glasgow.

THE property of withdrawing matters from a state of solution, possessed by the charcoal of bone-black, has been investigated in the case of soluble colouring matters of a vegetable and animal origin. It is known, that the discolouring faculty resides entirely in the charcoal, for the earthy matters and portions of azote combined with it possess by themselves no such power, and the charcoal discolours without them. This property is also greatly exalted by the state of extreme division and porosity of animal charcoal, arising from the interposition of foreign particles of earthy and saline matter between the particles of carbonaceous matter in bone, which effectually prevents the aggregation of the carbon during calcination. The bright, hard charcoal from the calcination of dried blood has no discolouring power; but the charcoal from the calcination of dried blood, mixed with carbonate of potash, as in the manufacture of prussiate of potash, proves the most efficient discolouring form of charcoal we possess, after the alkaline carbonate is washed out. A very intense heat, however, destroys entirely the discolouring power of bone-black.

The colouring matters are not destroyed or decomposed by the charcoal, but merely withdrawn from a state of solution, in combination with the surface of the charcoal, and may be again dissolved out and made to appear by the action of a more powerful solvent.

M. Lowitz first discovered this property of charcoal in 1791. He used only charcoal of wood. M. Guilbert observed, that the discolouring power of wood charcoal was improved, by exposing it for a considerable time in a wet state to the rays of the sun. In 1810, M. Figuier, Professor of Chemistry at Montpellier, discovered that animal charcoal discoloured with much greater power. It has subsequently

been used very extensively by the sugar refiners of France in clarifying their syrups. Of bone or ivory black, one sixth of the weight of the raw sugar is boiled with it for ten minutes. The charcoal and impurities are separated by filtering, and the syrup is filtered a second time to separate a little charcoal which comes through the first filter (Payen). In the *Journal de Pharmacie*, tom. iv., pp. 301—7, there is a distinct account of the mode of preparing bone-black, by M. Cadet de Gassicourt; and in the same work, tom. viii., pp. 257—277, an excellent memoir on charcoal, considered as a discolouring substance, by A. Bussy, which was crowned by the Society of Pharmacy of Paris, and contains every thing known on the subject. It is followed by another memoir on the same subject by M. Payen, to which a second prize was adjudged. The substance of the preceding memoir is given in this journal, vol. xiii., pp. 406—16.

But the action of animal charcoal on solutions has been considered hitherto only in reference to the removal of colouring matters. More determinate results, however, might be expected in solutions of saline and other chemical bodies, of which the composition is known. The investigation is also interesting, from the light which it may throw upon the state of combination in which bodies exist in cases of ordinary solution as salt in water, to which the doctrine of definite proportions seems wholly inapplicable. If a solid body, such as carbon, destroy such a combination and take down the saline matter attached to its surface, we may conclude that there is an analogy between the combination of the salt with the water, and the combination of the salt with the charcoal, and that the former as well as the latter processes have something of a mechanical character.

The same property is possessed by other solid bodies, in a state of minute division, as when newly precipitated, although not in so great a degree. And, in analytic researches, its interference must be guarded against, as it may contribute, in some cases, to increase the weight of precipitates.

The animal charcoal, employed in the following experi-

ments, was prepared from common bone, or ivory black, by boiling dilute muriatic acid upon it, and afterwards washing it with hot water till the water came off tasteless. No more than ten or twelve per cent of charcoal remained after dissolving out the earthy salts. On burning this charcoal, it left a gray ash, amounting to about one twelfth of the original weight, insoluble in water and acids, and almost entirely silica. Charcoal, prepared in this way, M. Bussy found to go no farther in discolouring than one and a half times its weight of the original ivory black.

In my first experiments, it was found that the prepared charcoal in great excess, had no sensible effect in impoverishing a saturated solution of common salt at natural temperatures. The proportion of salt remaining in solution was always as great as water was found capable of retaining, at the same time, at the lowest temperature which had occurred during the experiment.

A solution of nitrate of lead, with the charcoal repeatedly agitated, and occasionally tested with carbonate of soda, gave a distinct precipitate the first day, a much less distinct the second, and the merest trace the third day. But, on heating the water, the charcoal part of the nitrate was re-dissolved, and afforded a copious precipitate, with carbonate of soda and with sulphuretted hydrogen.

The dinitrate of lead, which is soluble, was taken down completely by the charcoal, so that no trace of it was perceived by means of sulphuretted hydrogen. But on heating the water over it to 200° , part was re-dissolved, as in the previous case, but again taken down completely by the charcoal on cooling. The action of the charcoal on the cold solution of the dinitrate was immediate, and much more energetic than in the case of the nitrate. The former salt, however, is much less soluble in water than the latter. Other soluble subsalts were tried.

2. Three grains diacetate of lead in one ounce water, with twenty grains common ivory black: taken down completely and not re-dissolved in any degree on boiling.

Four grains trisacetate of lead; same results.

Four grains tartar emetic in one ounce water, with twenty grains of the prepared charcoal, in the cold; agitated occasionally for several days; still a copious precipitate, with hyrosulphuret of ammonia. After a second addition of twenty grains of the charcoal, only a trace of antimony, with sulphuretted hydrogen.

Lime-water was deprived entirely of the lime which it contains, in the cold, as Dr Paris previously observed, so that the liquid remaining did not act on reddened litmus.

Arsenious acid was not taken down entirely in six weeks by great excess of the charcoal, no heat being applied.

No quantity of the charcoal could take down bisulphate of copper.

Ammonia was added in excess to bisulphate of copper, so as to form the deep-blue solution of ammonio-sulphate: the latter was readily taken down by the charcoal, and the liquid became perfectly colourless. Strong ammonia was digested in the cold upon the charcoal containing the salt of copper, and also boiled upon it, without dissolving a trace of it, as the ammonia did not become blue even when poured off and exposed to the air. In a certain experiment, the deep-blue colour of five grains bisulphate of copper in half an ounce of caustic ammonia, diluted with one and half ounces water, was much impaired by twenty grains of the charcoal. Increasing the charcoal every second day, by five grains at a time; with thirty-five grains, the colour had become very slight, and was entirely destroyed by forty grains; nor did the supernatant ammonia contain any protoxide of copper.

Five grains of nitrate of silver, in the same quantity of ammonia and water, with twenty grains of the charcoal. Next day no trace of silver in solution could be detected; two and a half grains nitrate of silver added; agitated occasionally with the charcoal, but after several days there was still silver in solution. On examining the phial containing the above materials some time afterwards, shining metallic spangles were perceived among the charcoal.

The solution of chloride of silver in ammonia was also taken down completely by the charcoal.

A solution was made of ten grains hydrated protoxide of lead in caustic potash, which was diluted with water till it amounted to three ounces. Twenty grains of the charcoal, added to the above solution, in a phial, which was then corked up, took down so much of the oxide of lead that the white colour of the latter substance was quite discernible among the charcoal. Here we have the colour of the charcoal disguised in the compound. Making successive additions of charcoal, the oxide of lead in solution was reduced to a trace by ninety grains; the last additions of charcoal floated over the heavy portion containing the oxide of lead; the supernatant solution, which had a greenish tinge, was poured off, and the charcoal washed, thrown on a filter, and dried at a heat which did not exceed 212° . When dry, innumerable metallic particles were visible in it; so that the oxide of lead is easily reducible by the charcoal attached to it.

The oxide of zinc was withdrawn entirely by the charcoal from solution in caustic ammonia.

A deep-red solution was made of five grains iodine in fifteen grains pure hydriodate of potash, dissolved in two ounces water. Forty grains of the charcoal were added before the colour of the iodine was wholly removed from the solution; the liquid acquired a faint acid reaction: the carbon was washed, and dried in a filter on the sandbath without exhaling iodine vapours; but on heating it strongly in a flask by a lamp, iodine rose in vapour, and condensed on the sides of the flask with some moisture. The iodine was afterwards re-absorbed by the dry charcoal when cold.

Labarraque's disinfecting fluid (chloride of soda with bicarbonate of soda) may be boiled without being materially injured; but I was surprised to find that ebullition for a few seconds of a large quantity of that fluid, in contact with a few grains of the charcoal, completely destroyed its bleaching power.

The same effect took place in the cold, on agitating the fluid and the charcoal together for a few minutes. No gas was emitted in either case. On evaporating the saline solution to dryness, it was found to contain no notable quantity of chlorate of soda. Twenty grains of carbon are adequate to destroy the bleaching power of a pint of the disinfecting fluid recently prepared.

A solution of common bleaching powder, chloride of lime, was destroyed by charcoal with nearly equal facility, particularly when hot.

A pound of water, recently impregnated with an equal bulk of chlorine gas, was heated rapidly to the boiling point, in contact with twenty grains of the charcoal, in a glass flask provided with a perforated cork and bent glass tube, for the purpose of collecting any gas which might be given off. Gas was collected, but it was entirely carbonic acid, and most of the charcoal disappeared: muriatic acid was found in the liquid. On collecting the unconsumed charcoal in this and other cases, and washing it several times after being dried on a sandbath, it gave out a few drops of strong muriatic acid, when heated in a glass tube by means of a lamp.—*Quar. Jour. of Science, &c.* Jan. 1831.

ART. XXIII.—*On the Mode of Ascertaining the Commercial Value of Ores of Manganese.* By Edward Turner, M.D., F.R.S. L. and E., Sec. G.S. Professor of Chemistry in the University of London.

THE analysis of the ores of manganese, when pure, is exceedingly simple. The operator need only, by well known methods, determine the water which the ore contains, and the oxygen which it loses in being converted into the red oxide. Its degree of oxidation, on which the commercial

value of ores of manganese so essentially depends, may then be readily inferred.

But when impurities prevail, as they almost always do, more or less, in commercial manganese, the analytic process is complex and troublesome ; and the presence of iron, which is rarely absent, renders an exact result by the ordinary modes of analysis almost impracticable. For, as I have elsewhere stated*, when peroxide of iron is strongly heated in mixture with peroxide or deutoxide of manganese, oxygen is given out by the former as well as by the latter ; and, accordingly, the oxygen lost by heat ceases to indicate the nature of the manganese. A moderately correct allowance for the quantity of oxygen emitted by the iron under these circumstances would be difficult, even after ascertaining in the moist way the quantity of iron contained in the ore ; since the constitution of the resulting oxide of iron, as well as its uniformity, is probably variable, and, at all events, is undetermined. The chemist would, therefore, have to ascertain separately each constituent of the ore, and consider the loss as oxygen belonging to the manganese,—a method not to be trusted in a complicated analysis, and which would be wholly inapplicable if the iron, as contained in the ore, should happen not to be uniformly oxidized.

I was led to reflect on these difficulties in consequence of being requested, some months ago, to examine a considerable number of different ores of manganese, the object being solely to ascertain the relative quantities of chlorine which an equal weight of each ore was capable of supplying ; and as the method to which I had recourse gives such information with rapidity and precision, I have drawn up a short description of the process ; not from any novelty being attached to it, but in the belief that it may be useful to persons engaged in a similar inquiry.

The method, in principle, consists in dissolving a given weight of the ore in muriatic acid, condensing the chlorine in

* Brewster's Journal of Science, N. S. ii. 213.

water, and, by some uniform measure, estimating the quantity of chlorine relatively to an equal weight of pure peroxide of manganese, selected as a standard of comparison. The substance first used with this intention was a solution of indigo; but a weak solution of green vitriol, employed by Mr Dalton for ascertaining the strength of bleaching powder, was found to be more precise in its indications.

The method of manipulating is as follows:—About ten grains of the ore in fine powder is introduced into a flask capable of containing about an ounce of water, and into its neck is fitted by grinding a bent tube about two inches long, which conducts the chlorine from the flask into a tube about sixteen inches in length, and five-eighths of an inch wide, full of water, and inverted in a small evaporating capsule, employed as a pneumatic trough. The apparatus being adjusted, the flask is half filled with concentrated muriatic acid, the conducting tube instantly inserted, and heat applied by means of a spirit-lamp. The air of the flask, together with the chlorine, is then collected, the greater part of the latter, if the gas is not very rapidly disengaged, being absorbed in its passage; and consequently, the receiving tube, at the close of the process, will be about half full of gas. When the ore is completely dissolved, the last traces of the chlorine are expelled from the flask by muriatic acid gas. In order that the chlorine thus collected may be entirely absorbed, the aperture is closed by a ground stopper, or, still more conveniently, with the finger, and the gas is well agitated until the chlorine is wholly absorbed. As the solution in the inverted tube may become too saturated to dissolve all the chlorine, it is convenient to fill a pipette with pure water, and, with the aid of the mouth, force a current to ascend into the tube, and thereby cause the heavier solution to flow out into the capsule.

The absorption being complete, the solution of chlorine is introduced into a six or eight ounce stoppered bottle, and a dilute solution of green vitriol, made, for example, with a hundred grains of the crystallized salt and a pint of water, is added in successive small quantities until the odour of chlo-

rine just ceases to be perceptible. The quantity of liquid required for the purpose may be conveniently measured in a tube about sixteen inches long, and three-quarters of an inch in diameter, divided into two hundred parts of equal capacity, and supplied with a lip, so that a liquid may be poured from it, without being spilled. In conducting this part of the process, the operator will perceive two odours:—at first, the characteristic odour of chlorine, accompanied with the peculiar irritation of that gas;—and subsequently an agreeable, somewhat aromatic odour, unattended with the slightest irritation. The object is, to add exactly so much solution of iron as suffices to destroy the former of these odours, without attempting to remove the latter; a point which, with a little practice, may be readily attained. The whole of the iron is thus brought into the state of peroxide.

The first trial is generally accompanied with some loss of chlorine, and should only be used as a guide to a second and more precise experiment. Accordingly, a weighed portion of the same ore is dissolved, and the chlorine collected as before, except that the solution of green vitriol, in quantity rather less than sufficient, is at once introduced into the inverted tube and capsule. A more ready and perfect absorption of the chlorine is thus effected, and the subsequent addition of a small quantity of sulphate of iron suffices for completing the process.

The principal sources of error in this method are the two following:—loss of chlorine, by smelling repeatedly, and exposure to the air when the gas is absorbed by pure water; and oxidation by the air when the absorption is made directly by means of the solution of iron. The small flask and inverted tube are apt to retain the odour of chlorine, and should therefore be rinsed out with the absorbing liquid. It should be remembered, also, that a given quantity of chlorine will emit a more or less distinct odour, according as it is less or more diluted. But by operating always in the same manner, and employing such weights of different ores, that equal quantities of the solution may contain nearly equal quantities

of chlorine, it is easy to be independent of these errors of manipulation, by causing them to affect each experiment to the same degree. It will accordingly be found, with a little practice, that results of surprising uniformity may be thus obtained; and even the constitution of pure oxides of manganese may be ascertained by this method, almost with the same accuracy as by directly determining the quantity of oxygen.

Journ. Roy. Instit. Feb. 1831.

ART. XXIV.—*On Indigo. By Andrew Ure, M.D., F.R.S., &c.*

AMONG the vast variety of vegetable products, there is probably none so interesting to science, by the curious complexity of its nature, and the protean shapes it may be made to assume, as indigo; and, certainly there are few more important to British commerce and enterprise, since it constitutes the most valuable article of export and remittance from Hindostan. At the four quarterly sales appointed by the East India Company, no less than twenty thousand chests of this dyeing drug are, on an average, brought annually into the market. A very considerable quantity of indigo is also imported into Europe from America and Egypt. It is not long since the Caracas and Guatamala indigo held a much higher character, and commanded a much better price than that of India; but the improvements due to the intelligence of our planters in the East have, within these few years, enabled them to prepare an article very superior to the finest American. The sequel of this paper will present satisfactory proofs of this assertion.

Indigo is procured from many different species of plants, belonging to Tournefort's natural family of the leguminous, included for the most part in the genus called *Indigofera* by

Linnæus. According to Heyne, the *Indigofera pseudo-tinctoria* cultivated in the East Indies, produces the best indigo; but others extol the *Indigofera anil*, the *Ind. argentea*, the *Ind. disperma*, which yields the Guatamala kind, and some the *Mexicana*. About sixty species of the *Indigofera* are at present known; but those above named are in peculiar esteem. My object in stating these differences here is chiefly to show that a drug obtained from such a variety of vegetable species must necessarily vary in composition. The matter which affords the indigo is confined entirely to the pellicle of the leaves, and exists in largest quantity at the commencement of maturation, while the plant is in flower; at a somewhat later period the indigo product is more beautiful but less abundant; afterwards, much less of it is obtained, and of a worse quality. The plant is remarkable for giving a blue tinge to the urine and milk of cows that feed upon its leaves; a circumstance which accords with the known permanence of the dye. The statement of Mr Weston, in this Journal (No. XXVII. p. 296),* agrees with these observations on the ripening of the blue principle. He shows that the developement of this matter in the *Indigoferas* goes on in the leaves, even after they are separated from the plant and dried. When packed up for a few weeks, more or less, according to their preceding state of ripeness, the leaves assume a light lead colour, which gradually deepens into a blackish hue. The planter studies to seize the period at which the *maximum* portion of colouring matter is formed, that he may then transfer the leaves to the steeping vat.

Three different processes are employed for extracting the indigo, each of which must modify more or less the nature of the product. In the first and second, the dried leaves are operated on; in the third, the recent plant. For the perfect success of the two former processes, the plant should be very speedily deprived of its water of vegetation; hence the *Indigofera* is reaped only in fair weather. An hour and a half before sunset, the plants are cut down, carried off the

* Quarterly Journal of Science.

field in bundles, and immediately spread on a dry floor. Next morning at six o'clock, the reaping is resumed for an hour and a half before the sun acts too powerfully on vegetation, and the plants are treated in the same way. Both cuttings become sufficiently dry by three o'clock, P. M., to permit the leaves to be separated from the stem by threshing. The leaves are now thoroughly dried by exposure to the sun, then coarsely bruised, or rather ground to powder in a mill, and packed up for the use of the manufacturer of indigo.

From these powdered leaves, the dye stuff is extracted either by simply digesting them in water, heated to 150° or 180° F., in as small a proportion as may be practicable, and subsequently beating the infusion with paddles till the blue indigo granulates, as Roxburgh recommended; or by mashing the ground leaves with twice their bulk of water, at the atmospheric temperature, drawing off the liquor into a vat, where it speedily undergoes fermentation, and is beat as above with paddles or oars, till the blue indigo forms. Some persons prescribe the addition of lime water at this stage of the process; others reject its use.

In operating on the recent plant, it is laid in bundles in the steeping trough (*trempoir*), which contains sufficient water to stand about two inches above plants slightly pressed down by crossing bars of wood. A brisk fermentation soon begins, with copious extrication of air-bubbles. This process is suffered to proceed till the liquor has become green, and casts up a pellicle of a copper red hue. A sour smell is now perceived, and the blue colouring particles seem ready to separate. This happens commonly at the end of from ten to twenty hours, according to the temperature of the weather. The liquor is then run off into the beating vat, and lime-water is added, or not, according to the fancy of the operator. In all cases of fermentation, whether the dried leaves or the recent plant be employed, it is proper to watch the progress of that change with solicitude; because, when too violent, it not only decomposes entirely some of the indigo blue, but introduces much foreign vegetable matter

into the precipitate; when too feeble, it is said to leave some indigo unextracted.

From the differences which exist in the nature and culture of the *Indigofera*, and of its treatment by the manufacturer, the product, *indigo*, as found in commerce, differs remarkably in quality and chemical composition. In this respect, it forms a complete contrast to the simple crystalline product sugar. Besides impurities accidentally present, from a bad season, want of skill or care, the purest commercial indigo consists of no less than five constituents—1. *Indigo-blue*, a very singular vegetable compound of carbon, hydrogen, and oxygen, with fully 10 *per cent* of azote.—2. *Indigo-gluten*, a yellow, or brownish-yellow varnish, which differs from wheat-gluten by its solubility in water. It has the taste of osmazome, or of beef-soup, melts when heated, burns with flame, and affords an empyreumatic oil along with ammonia by distillation.—3. *Indigo-brown*. This constituent is more abundant than the preceding. It is extracted by a concentrated water of potash, made to act on powdered indigo, previously digested in dilute sulphuric acid. Chevreuil's indigo-green seems to have consisted of this substance, mixed with some alkaline matter, and indigo blue.—4. *Indigo-red*. This is readily dissolved by boiling alcohol, out of indigo previously subjected to the action of an acid or alkaline menstruum. The alcohol acquires a beautiful red tinge, and leaves by its evaporation the red principle in the form of a blackish-brown varnish.—5. *Phosphate of lime*. I have found the bone phosphate in notable quantity in some fine indigo, constituting another feature of resemblance between this vegetable and animal products. Hence, also, the charcoal of indigo is most difficult of incineration, and requires, for perfect combustion in some cases, the deflagratory powers of nitric acid.

Pure *indigo-blue* is most easily obtained from the blue vat of the indigo-dyer; the yellow liquid of which being acidulated faintly with muriatic acid, and exposed, with occasional agitation, in a shallow basin, soon deposits the blue preci-

pitate, mixed, however, with a considerable quantity (more or less according to the quality of indigo used) of indigo-red. This must be removed from the dried blue powder, by the solvent action of boiling alcohol, applied in successive quantities.

In my paper on the "Ultimate Analysis of Vegetable and Animal Substances," which the Royal Society did me the honour to read at their Meeting in June 1822, and to publish in the volume of their Transactions for that year, I gave an analysis of *indigo-blue*, to which I appended the following remarks:—"I had intended to pursue at considerable detail my researches on this azotized product of vegetation, but the subject having been lately taken up by my pupil and friend, Mr Walter Crum, I was induced to leave it in his hands." I then thought it likely that some slight modification might require to be made in the weights of the constituents given by me, for "I did not (then) resume the subject of indigo, after I had become most familiar with the manipulations." I have found since that my mode of analysis was not in fault, but the revived *indigo-blue*, which I employed, had not been entirely purged of the red principle, by sufficient ebullitions with alcohol; for it adheres very tenaciously. Hence that resinous matter introduced a little oxygen and hydrogen, more than absolute indigo-blue contains. But the error will appear inconsiderable, if we compare the result with the analysis previously published by Dr Thomson. The following is a view of the ultimate constituents of *indigo-blue*, as given by different chemists:—

	Thompson.	Ure.	Crum.	Royer and Dumas.
Carbon	40.384	71.37	73.22	71.71
Oxygen	46.154	14.25	12.60	12.18
Azote	13.462	10.00	11.26	13.45
Hydrogen	0.000	4.38	2.92	2.66
	<hr/> 100.000	<hr/> 100.00	<hr/> 100.00	<hr/> 100.00

That pure indigo contains hydrogen, I have recently placed beyond a doubt, by heating a mixture of it and calomel in a green glass tube, the open end of which terminated

in an inverted tube, filled with nitrate of silver. Copious fumes of muriatic acid were evolved, and chloride of silver was precipitated in its characteristic curd.

The liquor of the dyer's vat (for calico-printing) contains indigo deoxidized by protoxide of iron, and dissolved in lime water. This solution, in its average state of richness, has a specific gravity not appreciably higher than that of distilled water, and affords out of 1000 parts, by weight, not more than 3 parts of indigo-blue, and nearly the same quantity of carbonate of lime, equivalent to about a grain and a half of quicklime in 1000 of the liquid; which is the proportion in common lime-water.

If that yellow liquor be introduced into a glass globe, with a graduated stem, previously filled with hydrogen, by plunging the vessel into the vat, we may transfer a portion of deoxidized indigo conveniently to the mercurial pneumatic trough, and measure the quantity of oxygen which a given bulk of it absorbs in becoming blue. This quantity will be proportional to the strength and purity of the vat-liquor. I have lately instituted a series of experiments, the results of which will, I hope, prove interesting in reference to the problem for determining the quality or purity, and strength, of different commercial indigos; but they are not yet mature enough to meet the public eye. The rigid mode of examining this drug is to eliminate the *indigo-blue* from the other substances, by the readiest artifices of analysis, and to weigh it apart. It may be objected to the analysis of indigo, that it is too complex and operose a process to be practicable with the despatch and to the extent which the public quarterly sales of indigo require. But I conceive this to be a mistake. When only one object is pursued, various arrangements may be contrived for readily attaining it. Under this conviction, I ventured to state, ten years ago, in the introduction to the first edition of my Dictionary of Chemistry, that "the result of numerous researches, made with that view, has shown me the possibility of rendering analysis in general a much easier, quicker, and more certain operation, than

it seems hitherto to have been in ordinary hands." My experience since has fully justified that statement.

Accordingly, about three years ago, I suggested to the honourable court of Directors of the East India Company, the propriety of establishing an Assay Office for Indigo in Calcutta, to guide them in their purchases of that article, and to enlighten the manufacturers in Bengal about the value of their various products and processes; and I again submitted to their consideration, last autumn, a memorial to the same effect, in which I detailed the advantages likely to accrue from such establishment to indigo-planters, dealers or brokers, and consumers. But the court did not think it expedient at present to make any alteration in their indigo department. The quantity of indigo required, for the assay need never exceed ten grains, provided a very delicate assay-balance be employed; and by a suitable system of arrangements, the average quality of 500 chests may be accurately determined in the course of a day, by a diligent chemist, with four or six ordinary assistants to follow his directions.

REVIEW.

ART. XXV.—*Researches on the Chemical and Medical Properties of the Root of Kahinca. By MM. Francois D.M. Caventou and Pelletier, Pharmaciens, Members of the Royal Academy of Medicine. (Extracted from the Journal Generale of Medicine, May, 1830.) Translated by John Baxter M.D. Member of the Medical Societies of Philadelphia and New York.*

THE above is the chief part of the title to a pamphlet of fifty-two pages. The memoir on the root of the Kahinca was originally read before the Royal Academy of Sciences, 27th December 1829. We have not had access to the "Journal Generale de Medicine," in which it was published or we should greatly have preferred translating some account of this interesting article for ourselves. As it is, we shall endeavour to *translate* some of Dr Baxter's translation for the benefit of our readers. We feel very much disposed to view with indulgence every effort of our medical brethren either for fame or emolument, because we hope for some little indulgence from their wonted generosity for ourselves. But we would take the liberty of suggesting to Dr B. the propriety of elaborating a little more the productions of his pen.

He has translated two or more editions of Magendie's Formulary—which with the pamphlet before us bear inexcusable marks, either of negligence or ignorance. We are at a loss to decide whether the translator of these works is an American or a Frenchman ; for he certainly does not under-

stand the idioms of both languages, or he would not send to the press and the public the words of one with the idiom of the other. As to the correctness of the translation we cannot pretend to determine as we have not the original to compare it with, and some parts are nearly unintelligible. But leaving the classical English of the translator, we shall proceed to give some account of the Kahinca. It will perhaps be remembered by some of our readers that we published in No 1, vol. ii. p. 84, of our journal a short notice of this article and its active principle.

It appears from the statements of the French chemists in their memoir, that the first account of this medicinal plant was published in 1826 in some European journal by Major Langsdorf, consul general of Russia at Rio Janeiro. This shrub called by botanists, *Chiococca racemosa* is a native of the interior provinces of Brazil. Its medicinal properties have been long known to the natives of that country, and it has been employed as a remedy by some of the physicians of the empire. But it is only lately that it has attracted the attention of the chemists and physicians of Europe, and it promises to prove a valuable addition to the class of diuretics.

It bears the popular names of *Kahinca* or *Cainca*, *Kahinina*, from being used to cure the bite of a serpent called *Camiana*, and *Raiz Preta* or black root. In the museum of natural history of Paris there are two of these shrubs nearly two feet in height. A botanical description has been given by M. Achille Richoud. The *Chiococca racemosa anguifuga flore luteo* belongs to the family Rubiaceæ, and to the class pentandria, order digynia of Linnæus. Generally it does not exceed a height of five or six feet, though sometimes it assumes the dimensions of a moderately sized tree and attains an elevation of thirty feet. The stem is smooth, ligneous and branching; the branches are slender, the leaves opposite, elliptical, acuminate, entire, smooth, green on both surfaces, and supported on short footstalks. There is a small caducous stipula on either side of the

stem between each pair of leaves; the flowers are yellow, and in small clusters at the angle formed by the junction of the leaves and branches, and are about as long as the leaves. The calyx of the flower is globular, and adherent with the ovary inserted; it is terminated above by a limb dividing into five small teeth; the corolla is monopetalous, spreading and almost bell-shaped, with five reflected lobes. The five stamina are slightly salient; the fruit is a small berry very white and compressed.

This shrub prefers uncultivated and sterile places, the barren earth of which is compact and hard, as may be inferred by the solidity of its root, the close texture of its fibres, and the ease with which the bark may be separated. This root is of a moderate size, invested with a brown or amber-coloured bark, having an aromatic and nauseous odour, and very bitter taste. The bark is hard, brittle and compact covering a white medullary substance, insipid and inodorous, and which constitutes nearly the entire mass of the root. So slight is the connexion between the root and its cuticle, that the latter may be entirely separated by simply bruising it between two hard substances.

We shall endeavour to condense the account of the analysis of this root as much as possible.

After exhausting a portion of it by successive macerations in alcohol of 35° B., the tincture was subjected to distillation in a water-bath until $\frac{3}{4}$ were drawn off. The remainder was transferred to a platina capsule and evaporated at a slow heat until some zones of concrete matter were perceived upon the sides of the capsule. After standing for twenty-four hours the liquor was observed to have assumed the form of a gelatinous mass, in which was contained a matter that seemed opposed to a regular crystallization. This mass was treated with cold distilled water until the fluid ceased to act on it. It was then filtered in order to collect a flocculent, yellow brown, aromatic, greasy looking substance. The latter, when purified by boiling in water and solution in ether, was of a green colour and the whole virulent material of the

root resides in it. That which remains undissolved by the ether is soluble in alcohol, granular, insipid and of the colour of Spanish tobacco.

The aqueous solution, from which the greasy matter was separated, retains all the bitterness of the root; reddens the vegetable blues; yields no precipitate with caustic ammonia; is slightly troubled by the alkaline carbonates; precipitates by acids and the tincture of nut galls.

Another portion of the same aqueous solution, when evaporated to a proper point for crystallization, again assumed the form of a concrete mass; and the operators were unable to make it crystallize.

They therefore poured into a third portion of the aqueous bitter solution a sufficient quantity of sub-acetate of lead, to precipitate all the material susceptible of being acted upon by this reagent. The abundant precipitate was separated by a filter, and the liquor was found to be nearly colourless and to be deprived of all bitterness.

This precipitate was repeatedly washed in boiling distilled water, and a current of sulphuretted hydrogen passed through these washings when united. The sulphurets of lead being separated, the liquor was again evaporated and left to itself. Some crystals were obtained at the end of several days formed in the midst of a thick viscid matter. These crystals were acetate of lime.

The sulphuret of lead of the last experiment was again treated with distilled water, through which more sulphuretted hydrogen was passed. The liquor procured by filtration yielded by evaporation a yellow extractive matter slightly bitter.

The bitter principle still continued united with the sulphuret of lead, and this was therefore subjected to the repeated action of boiling alcohol, until it ceased to acquire bitterness.

These tinctures were united and two-thirds drawn off by distillation, when, before the remainder was cold, distinct

needle-shaped crystals were deposited almost *en masse* of a yellow brown colour.

These were redissolved in boiling alcohol with animal charcoal, and handsome crystals of the bitter principle were procured.

From this analysis four distinct substances were procured, viz :—

1. A crystallized principle containing all the bitterness of the root.
2. A fatty green matter of a nauseous smell, in which resides all the odour of the root.
3. A yellow colouring matter.
4. A coloured viscid substance.

Properties of the Bitter Principle.

This principle when pure is white, and crystallizes in minute needles which assume an arrangement similar to those of muriate of morphia.

It is destitute of odour, and its taste which is scarcely perceptible at first, soon becomes exceedingly bitter and leaves a slight and evanescent impression of astringency in the throat. It is permanent in the open air, being neither efflorescent, nor deliquescent. At the temperature of boiling water it is unaltered in colour and form, but exposed in a glass tube to the action of an alcoholic lamp it is decomposed. It softens, carbonizes and becomes converted with a thick, white heavy vapour, which condenses on the sides of the tube partly in mass and partly in very light and small brilliant crystals. Both the crystals and the concrete mass appear to be destitute of bitterness and to be in fact of another nature from the original principle. No ammonia was evolved during the combustion. Burnt in a platina crucible when perfectly pure it leaves no residue, but its affinity for lime is so strong that it is exceedingly difficult to separate it from this earth.

More than six hundred times its weight of water are required to dissolve it, and its solubility in ether is also very

slight; alcohol is its appropriate solvent. Boiling alcohol takes up more than cold, and the salt separates on cooling in a crystalline form. The most singular feature of this vegetable principle is the property which it possesses of reddening the vegetable blues, in the same manner as the acids. The translator further says: "The action of concentrated acid on the bitter principle is not less remarkable: the sulphuric dissolves it, and *carbon* immediately *decomposes* it." Does he mean that *carbon* is a concentrated acid? or that carbon unaided by heat will decompose it? It is dissolved by hydrochloric acid, and the solution immediately assumes the form of a transparent gelatinous mass. This mass dissolved and washed in water appears destitute of all bitterness.

Nitric acid acts on it, and is itself decomposed, evolving the fumes of nitrous gas. The result is a bitter yellow matter in which is found no trace of oxalic acid. These acids when diluted scarcely act on the bitter principle.

The effect produced by the radical acetic acid depends upon the temperature at which it is employed. If the solution be made cold, unaltered crystals will reappear by spontaneous evaporation; but if heat be applied the mixture becomes brown, and by standing assumes the shape of a gelatinous mass, similar to that produced by the mineral acids, and destitute of all bitterness.

When this principle is mingled with the solutions of ammonia, potash or baryta, it unites very readily with the three alkalies, but forms no crystallizable salts. When added to lime water, the latter preserves its transparency, but if lime in excess be employed, a considerable precipitate immediately follows, which is a sub-combination of the bitter principle and the lime. Alcohol dissolves this compound, but when hot it takes up a larger proportion, from which by standing it separates in the form of flakes, possessing strong alkaline properties, and capable of restoring vegetable blues reddened by an acid. The solution of this principle in common lime water, like the other solutions affords no crys-

tals by evaporation. But all of these combinations of it with alkalies are soluble in alcohol, and possess great bitterness. They are also dissolved by water and may be decomposed by acids, added to the solution. The French chemists state that this bitter principle exists in the root of the Kahinca in the form of a sub-salt with a base of lime. It possesses some properties which are peculiar to itself; but from the existence of those qualities which entitle it to rank with the acids, the discoverers have designated it by the title of *Kahincic acid*.

It is not our intention to say much respecting the therapeutic action of this remedy. But as it is nearly unknown in this country and appears to possess properties which entitle it to a high rank in the materia medica, we shall detail a few of the results obtained by the French physicians. They have administered the powdered bark of the root in doses from 10 grs. to 1 drachm, but as its operation is somewhat uncertain in this form, they prefer the aqueous extract, which operates with more certainty in doses, of 12, 15 or 20 grains. They also gave it in the form of enema with very happy effects. It is not very prompt in its action, and appears to affect chiefly the lower bowels when it proves cathartic. It either determines to the kidneys or the bowels, and when one of these effects takes place the other usually does not precede or follow; sometimes, however, the diuretic succeeds to the cathartic action after a lapse of some hours. The Kahinca occasionally produces nausea and pain, but generally its operation is mild and certain. Its medicinal properties may be said to be tonic, cathartic, and diuretic; and, from the cases recorded by the French physicians, we have every reason to hope and believe it may prove one of our most effectual remedies in the cure of dropsy.

Minutes of the College.

March 29th, 1831. The Board of Trustees informed the College of the election of Dillwyn Parish as a resident member.

The Treasurer's report was read and adopted.

The following gentlemen were duly elected officers, trustees, &c. for the ensuing year.

President,—Daniel B. Smith.

Vice Presidents,—Henry Troth, Samuel Jackson, M.D.

Secretary,—Charles Ellis.

Treasurer,—Edward B. Garrigues.

Corresponding Secretary,—Elias Durand.

Trustees,—Alexander Fullerton, Jun., Warder Morris, Samuel C. Sheppard, Joseph Reakirt, John Carter, Edward Needles, Robeson Moore, Charles H. Dingee.

Publication Committee,—Benjamin Ellis, M.D., Daniel B. Smith, George B. Wood, M.D., Samuel P. Griffitts, Jun., Charles Ellis.

June 28th. The Board of Trustees informed the College of the election of John Milhan, of New York, as an associate member of the College.

A vacancy having been occasioned in the Board of Trustees by the decease of Dr Benjamin Ellis, the College duly elected Peter Lehman a Trustee for the unexpired time of Dr Ellis.

Adjourned meeting. June 30th. The Publication Committee reported, that from the sudden death of Dr Benjamin Ellis, the editor of the Journal, they had been induced on

their own responsibility to engage Dr R. E. Griffith to edit the number now in the press.

It was on motion resolved, that the member of the Publishing Committee who acts as Editor of the Journal, may receive for his services all the clear profits of it, until they amount to 100 dollars, and then in addition such portions of the profits over and above that sum, as the College may from time to time determine.

The Board of Trustees having recommended Drs Franklin Bache and Robert E. Griffith, as suitable candidates for membership in the College; the College proceeded to ballot for them, when they were duly elected.

On motion, the College, on recommendation of the Publication Committee, proceeded to elect a member of that committee to supply the vacancy occasioned by the death of Dr Benjamin Ellis, when Dr Robert E. Griffith, was duly chosen.

On motion, resolved, that the Publication Committee are authorized to reprint 250 copies of No. 3, vol. 1st, and to draw if necessary on the Treasurer of the College for funds to defray the expense of the same.

Extract from Minutes of the Board of Trustees.

On motion, the Board proceeded to ballot for a Professor of Materia Medica, to supply the vacancy occasioned by the death of Dr Benjamin Ellis, when George B. Wood, M.D. was duly elected.

The Professorship of Chemistry being declared vacant by the election of Dr Wood to that of Materia Medica, it was on motion resolved, that the Board proceed to election of a person to fill that vacancy; whereupon Franklin Bache, M.D. was declared duly elected.

MISCELLANY.

Berberine.—From an analysis of the root of the barberry (*Berberis vulgaris*) by MM. Buchner and Herberger, it appears that it contains a new principle, which they term Berberine. From 100 parts of the root they obtained 17 parts of this salt, which is of a yellow or brownish colour, very bitter taste, slowly deliquescent, and decomposed by any degree of heat above 167° Fahr. It is very soluble in water and alcohol, but not in pure sulphuric ether. The solutions are of a brown colour, of great intensity: even one part of berberine will tinge 4500 parts of water. The best mode of preparing it is:—The root being deprived of its volatile oil, fatty matter and wax by means of sulphuric ether, the residue is to be treated by alcohol at 107° Fahr.; this tincture is to be evaporated to the consistence of extract; the residue redissolved, filtered and caustic ammonia added, which will cause a precipitate; it is to be again filtered, and evaporated by a gentle heat, acetic acid being added to neutralize any excess of ammonia. The residue is to be again dissolved in alcohol, from which the berberine will be obtained in a pure state on evaporation.

This article acts like rhubarb, and with equal promptness and efficacy.—*Journ. de Pharmacie*. Jan. 1831.

Colombine.—Mr Wittstock of Berlin has obtained a new crystalline substance from the Colombo root, which he calls Colombine, by the following process. The Colombo root is to be treated with alcohol a 0.835; this tincture to be distilled in a water bath till it is reduced to one third or one quarter, the residue to be permitted to stand undisturbed for some days, when crystals will be formed, which are to be washed, and boiled with a little alcohol and animal charcoal in order to purify them. A further quantity of crystals may be obtained from the mother-water, by evaporating it to dryness in a water-bath, after having added animal charcoal: the extract, after being reduced to powder, is to be treated several times by ether (0.725) and distilled, and the residue left to evaporate spontaneously, the wax, fatty matter and the Colombine will gradually be deposited, and the latter can then be separated by means of acetic acid. By this means Mr Wittstock obtained one drachm of Colombine from sixteen ounces of the root. The crystals are transparent quadrilateral prisms with rhomboidal bases. A single grain is sufficient to kill a rabbit.—*Journal de Pharmacie*. Feb. 1831.

Preparation of Liquid Ammonia.—*Bizio*.—A tubulated retort is to be put into a sand-bath, and connected with a small balloon placed on a little furnace; a tube

is to proceed from the balloon to a flask which is to be supplied with a safety tube, and with another tube dipping into a mercurial bath. Equal parts of sal ammoniac and hydrated lime are to be used; the lime is to be made into a cream with water, and put into the retort, and then the powdered sal ammoniac added; after being well mixed the retort is to be closed; water, equal in weight to the sal ammoniac, is to be put into the flask; the retort in the sand-bath to be heated, and the balloon moderately warmed. As the ammoniacal gas is disengaged it will be absorbed by the water in the flask. By managing the fire properly, and distilling the portion of impure ammonia in the balloon, pure ammonia of the s.g. of .910 will be obtained, sixteen pounds being produced for every ten pounds of sal ammoniac employed. M. Bizio says that the ordinary processes do not give more than one half of this quantity.—*Bull. Univer.*

Singular Action of Arsenic on Sugar.—When a solution of pure arsenic acid is mixed with sugar and left for a few hours, a rose colour is produced which soon becomes a fine purple, and then remains with little further change, for many days. Sugar of milk, mannite, raisin sugar, sugar of starch, produce similar effects; but sugar of liquorice, diabetic sugar, and such bodies as starch, gum, &c. produce no effect of the kind. Nor do the soluble arseniates or arsenious acids produce these effects with the substances named above.—*Ibid.*

New Substance found in the Semen Contra (Artemesia Judiaca), by M. Kahler.—This pharmacist treated a pound of the semen contra by ether till the latter was no longer coloured, and distilled the tincture in a tubulated retort with a spirit lamp. The residue was of an oleaginous consistence. The next day he found the bottom and sides of the retort covered with small crystals, which he dissolved in warm ether; crystals again formed on cooling. The supernatant ether was evaporated by a gentle heat, and the crystals dissolved in warm alcohol of 0.896, to which a little hydrochloric acid had been added. The solution took place before the alcohol came to the boiling point, and crystals were formed after the fluid was left for twenty-four hours in a temperature of 59° Fahr. The crystals possessed the following properties. They were soluble in ether and alcohol. They combined with hydrochloric acid, but their affinity was feeble. They are soluble in ammonia by heat, almost insoluble in water. Scarcely any smell or taste. When exposed to the rays of the sun they became yellow, and at a high temperature burnt with a beautiful flame.—*Journal de Pharmacie. Feb. 1831.*

Salicine from the Athenian Poplar; from a Memoir of M. Braconnot on Salicine and Populine. M. Braconnot having employed the bark of the populus tremula with success in fevers of various kinds, satisfied himself by some experiments that it contained, 1, salicine; 2, corticine; 3, populine; 4, benzoic acid or its elements; 5, a gummy matter; 6, a principle soluble in alcohol, which reduced the salts of gold, silver and mercury; 7, tartrates of lime and of potassa.

The discovery of salicine in the bark of the aspen induced M. Braconnot to seek for it in other vegetables. His researches have proved it to exist in the populus alba, the populus græca (Athenian poplar), in the salix fissa, amygdala and helix; and he has remarked that in certain species of willow both the salicine and tannin disappear entirely and give place to a saccharine matter.

M. Braconnot's process for obtaining the salicine is as follows. He makes a decoction of the bark of the aspen, and pours into it subacetate of lead. The colourless liquid thus obtained is deprived of its excess of lead by its sulphuric acid.

A little washed animal charcoal is then added, and the boiling liquid being filtered is put aside, and deposits the crystallized salicine upon cooling.—*Journ. de Chim. Med.* Jan. 1831,

Carbonate of Iron.—The observations of Mr Clarke, in a short article on the preparation of carbonate of iron, are well deserving of attention. He states, that when this medicine is prepared according to the direction of the British Pharmacopœias, it absorbs oxygen so rapidly while drying as to be almost entirely converted into red oxide, a substance very different in its medicinal properties, and which may be given to almost any extent without producing any apparent effect except in the fecal evacuations; to which circumstance, we have no doubt, are owing the very different reports which have been made by various practitioners as to the dose and properties of this substance. Mr Clark, therefore, proposes to avoid the exposure of the precipitate to the action of the air, and gives the following formula, by which a true carbonate may be obtained.

“Take of sulphate of iron and subcarbonate of soda, each eight ounces. Pound each salt, and dissolve separately in warm water. If necessary, filter. Being filtered and cooled, mix the solutions in a deep vessel, capable of holding one or two gallons of water, which fill up with cold. Stir—let subside—and decant the clear liquor from the precipitate. Fill up again with water and likewise again decant; and repeat the operation two or three times so as to separate the soluble salts. Next put the precipitate on a filter of cotton or linen cloth supported by a square frame. When the water has ceased to pass, gather into one hand the edges of the filter, so as to make a sort of bag, and with the other twist it round from the holding hand downwards, so as to squeeze out the remaining water. The precipitate will now have the appearance of clay, too soft for moulding. With soft sugar and aromatic powder make into an electuary.” “Thus,” says he, “we obtain a carbonate of iron, uniform in its proportions, hardly deteriorated by the process it undergoes, and little liable to change by keeping.”—*No. 383, Lancet.* Jan. 1, 1831. —*From the Glasgow Med. Journal.*

Adulteration of Strychnine.—M. Robiquet mentions that this article is very often adulterated by the admixture of various inert articles, even to the extent of forty or fifty per cent. The substance principally used for this purpose is magnesia. This fraud may be detected by calcining the suspected sample. Another mode of adulterating is by mixing the impure strychnine with ivory black, which contains phosphate of lime, and then adding undiluted acid, which takes up the strychnine and the earthy salt; this solution is then filtered and precipitated by ammonia, thus producing a mixture of the vegetable alkali with no inconsiderable quantity of the phosphate. Calcination will detect this fraud also.—*Journal de Pharmacie.*

Nicotine.—MM. Posselt and Reimann have completely succeeded in separating the alkaloid principle, which Vauquelin believed to exist in tobacco, but which that distinguished chemist failed to obtain in a separate state. This new substance, nicotine, as described by the present authors, is liquid at 44° Fahr., transparent, of a brown red colour, of a disagreeable, pungent odour, like that of dried tobacco, and which is increased by an elevation of temperature, taste exceedingly acrid, and remaining long on the tongue. It communicates a greasy stain to paper, disappearing in twelve hours; specific gravity greater than water; volatile in the open air, leaving a small resinous residuum; boils at 460° Fahr., burns when touched by a lighted taper, and at 212° Fahr. evolves abundant white vapour. Nicotine is

soluble in water in all proportions, the solution is decidedly alkaline, and, diluted with 10,000 parts of water, still preserves its acrid taste. It is equally soluble in alcohol, ether and almond oil. The ethereal solution, mixed with muriatic, tartaric or acetic acid, parts with all its nicotine, and salts insoluble in ether are produced. Neutralized by phosphoric acid, the new alkaloid furnishes a colourless syrup, which, when exposed to the sun's rays, affords crystals like cholesterme. The sulphate of nicotine assumes the form of an amorphous mass, slightly acid. Finally, with oxalic acid, nicotine forms a crystalline soluble compound. The nitric acid does not unite with it, but nearly effects the decomposition of this alkaloid.—*Geiger's Magazin sur Pharm.*—*From the New York Med. Journ.*

Trees furnishing the Cinchona.—From various investigations M. Deirbach, Professor at Heidelberg, has come to the following conclusions.

The best Cinchona comes from Peru and New Granada; the Brazilian barks are of less value, and those from Asia have not been sufficiently investigated. The most valuable species, and those richest in the alkaloids, are found in the most elevated and coldest of the tropical regions of the new world. The species which grow in low and warm situations in the same regions, furnish barks of much less power. The cinchonas of Peru are generally richest in *Cinchonia*, and those of New Granada in *Quinia*. Peru generally furnishes the brown and gray kinds; New Granada, the yellow and red. The species, which contain the greatest proportion of alkalies have for the most part a hairy corolla of a red or violet colour. Those on the contrary which contain but little of these constituents, generally have a smooth and white corolla. The smooth or hairy state of the leaves furnishes no certain indications.—*Bull. des Sciences.*—*From Geiger's Mag.*

Method of preparing Piperine and of obtaining it pure on the first or second Crystallization, by P. F. Tonery.—Two pounds of ground black pepper are to be introduced into a matrass, and three pounds and a half of alcohol at 36° added to it; this is to be digested at a heat of 100° to 112° Fahr. progressively elevating the temperature to 172° or 177° Fahr.; this fluid is then to be decanted, and a fresh portion of alcohol added; and the process repeated; the residue is to be pressed, all the fluids united together and permitted to cool to give time for the fatty and flocculent matter to precipitate; this tincture is to be filtered, when it will be of a brown colour; it is then to be treated by about six or seven ounces of the protoxide of lime, added gradually, after which it is to be heated by degrees to ebullition, and often stirred; the brown colour soon assumes an opaline tint, when this has taken place, the liquid is to be decanted, and the calcareous residuum treated with boiling alcohol. These fluids are to be united together, filtered and kept in a temperature of from 75° to 85° Fahr. when well defined crystals of piperine, of a slightly opaline colour, and almost deprived of colouring matter, will be formed by the spontaneous evaporation.

As the last portions of the mother-water crystallize with great difficulty on account of the presence of a resinous matter, it is to be precipitated by water acidified by hydrochloric acid or by simple water. The silky precipitate redissolved in boiling alcohol, and the process continued as before.

The products resulting from these operations only require, to render them pure, to be redissolved in boiling alcohol at 36°, the solution to be slightly concentrated, filtered and again permitted to crystallize as at first, when the piperine will be formed in beautiful prisms and almost white.—*Bull. des Sciences.*

Ruspini's Styptic.—This preparation, which has obtained some celebrity in England for restraining hemorrhages that cannot be commanded by the needle and ligatures, has lately been analysed by Dr A. T. Thomson, who gives the following result of his experiments in the London Med. and Phys. Journal for March.

"From the effects of the tests employed, there is no doubt that gallic acid is the active principle of this styptic; minute quantities of opium and sulphate of zinc, which I have ascertained it also contains, being of no account, from the smallness of their proportions; the vehicle is alcohol, with a small quantity of rose water, to give it odour. Alcohol dissolves one fourth of its weight of gallic acid; an excellent styptic, therefore, may at any time be extemporaneously prescribed.

New mode of preparing Medicines with Sugar, by M. Beral.—At the meeting of the Royal Academy of Medicine, on the 9th of February, 1830, M. Guibourt made a report on a new mode of preparing remedies with sugar, by M. Beral, pharmacist of Paris. M. Beral first makes tinctures of the medicinal articles with alcohol and ether; these tinctures are afterwards poured upon sugar broken in small pieces, the alcohol or ether is then evaporated, and the medicinal principles which they had in solution remain with the sugar. M. Beral thus obtains a medicated sugar, which may be granulated or powdered for use.

The committee regard these preparations as very useful, and consider them as possessing the following advantages: 1. They contain the medicinal principles isolated from the substances employed in their preparation; 2. The medicinal principles are separated from the stimulating articles in which they are dissolved; 3. They are soluble in water; 4. The doses can be determined with accuracy; 5. Many of the medicinal syrups, in which the dose of the medicine is not well known, may be replaced by the syrup saturated in determined proportions; 6. These preparations may be substituted for the oleum saccharum, used at present to give an aromatic flavour to many medicinal preparations.—*Journ. Gen. de Med.*

Kermes Mineral.—The composition of Kermes mineral, as determined by Berzelius and Rose, in accordance with Philips, has lately been called in question by the French chemists. According to the former, it is exactly the same substance as the common native sulphuret of antimony. Robiquet, Buchner, and Henry, Jr., who found it to contain oxide of antimony, have been joined by Gay-Lussac, who says (*An. de Chim.* xlii. p. 87), that, when treated with hydrogen gas, it gives off water, and that it is in fact a compound of 1 atom oxide of antimony + 2 sulphuret of antimony. Rose has therefore repeated his experiments (*Poggendorfs Annalen*, xvii. 324) with his former results. He prepared his kermes by boiling carbonate of soda on the common sulphuret of antimony, filtering, setting it aside to cool, filtering it again in half an hour to collect the precipitate, drying it well on bibulous paper, and afterwards by a gentle heat till it ceased to lose weight. He found the kermes thus prepared to give no water in a current of hydrogen gas, but to leave 72.71 per cent of metallic antimony. His former analysis gave 72.32 per cent, and Berzelius found in the common sulphuret 72.77 per cent. The residual liquid, according to Rose, after some hours, becomes troubled, and deposits a white sediment, being oxide of antimony combined with soda. If the kermes be not filtered, soon after its deposition, it will thus be contaminated both with oxide of antimony and with alkali; and this is probably the source of the oxide found by the French chemists. Since no carbonic acid is evolved during the preparation of the kermes by this process, all that takes place

is a mere solution of the sulphuret of antimony in the carbonated alkalies.—*Edin. Journ. of Science.*

Hydriodic Ether.—Serullas gives the following improved process for preparing this substance. Into a tubulated retort are introduced 40 gram. iodine, and 100 alcohol of 38° B. Agitate and add 2.5 grains of phosphorus in small pieces. Distil nearly to dryness; add 25 or 30 grains alcohol, and distil again till nearly dry. Water throws down the ether from the solution. After washing, it is to be distilled from chloride of calcium.—*Ann. de Chim.*

Preparation of Phosphorus.—Wöhler recommends, as likely to give phosphorus by a strong heat, ivory black with half its weight of fine sand and charcoal powder. A silicate of lime is formed, and the carbonic oxide and phosphorus come over.—*Pog. An. de Phys.*

Phosphuret of Sulphur.—When the protochloride of phosphorus is exposed to the action of sulphuretted hydrogen, heat is evolved, and there is formed a solid yellow substance without any apparent crystalline form, and adhering strongly to the glass. This is a phosphuret of sulphur. At common temperatures it decomposes water, and at length disappears in it, forming sulphuretted hydrogen and phosphoric acid. Its atomic constitution is probably
2 atoms phosphorus + 3 atoms sulphur.

Edin. Journ. of Science.

Discoloured Chloride of Silver.—Chloride of silver blackened by sun-light is perfectly well known. M. Chevalier obtains it in a similar state by dissolving the recent chloride in ammonia, and passing chlorine gas into the solution; the usual decomposition of ammonia with elevation of temperature, evolution of azote, &c. takes place, and ultimately the liquid becomes turbid, and the chloride of silver appears first gray, and then when the ammonia is entirely decomposed, as a violet precipitate. This precipitate dissolves entirely in ammonia, and is precipitated in a perfectly white state by pure nitric acid. If twenty grains of it be decomposed by zinc in dilute sulphuric acid, it yields fifteen grains of silver, exactly the quantity yielded by similar treatment from twenty grains of white chloride. Hence the difference of the chloride in these two states cannot be referred to difference of composition, but solely to some variation in molecular arrangement.—*Journ. de Pharmacie.*

New kind of Indigo.—The *Registro Mercantil* of Manilla describes a new kind of indigo lately discovered in that island. This plant has long been known to the natives, especially in the provinces of Carimini and D'Albay: they give it the name of *payanguit* or *avanguit*, and obtain a superb blue colour from it. In 1827 it attracted the attention of Pere Mata, one of the members of the Economical Society of Samar. He made experiments with it, formed it into cakes, and dyed cotton, linen and silk goods with it. The colour he obtained was so rich, and so equal to that of indigo, that he sent some of the cakes and dyed fabrics to the Society, who directed other members residing in the same province to repeat Pere Mata's experiments. All obtained the most satisfactory results, and they sent many of the cakes, leaves and even the living plants to Manilla. A committee of merchants and chemists was appointed to ascertain, by every kind of trial, whether the colouring matter was identical with that of indigo, and might be introduced

as such into the market at the same price. The committee reported in the affirmative, and declared that it had all the valuable properties of indigo.—*Bull. Univ.*

On Efflorescence, by M. Gay Lussac.—Many salts when exposed to air effloresce, i. e. lose their water of crystallization and fall into powder; it is generally supposed that those salts, when thus effloresced, are anhydrous. Having known for a long time that this was not the case, I have made some experiments on the salts which are principally efflorescent.

Hydrated sulphate of soda exposed to air, even in damp weather, loses all its water of crystallization.

Phosphate of soda soon becomes opaque, but does not change its form. After three months' exposure, it contained, on July 18th, 7.4 proportions of water instead of 12, its full number. Reduced to powder, and exposed in thin layers on paper to air, till the 26th of the same month, it gave 6.5 proportions. Again exposed during a hot and dry period until the 31st of July, it gave only 5.65 proportions. Then being left exposed until the 21st of October, the quantity of water had increased to 7.2 proportions. Phosphate of soda, which had been calcined, acquired half a proportion of water, by being exposed to air for five days.

Carbonate of soda has the same habitudes as the phosphate; it becomes opaque, and loses much water without changing its form, but it never becomes anhydrous.

It results from the observations that some salts lose all their water of crystallization by exposure to air, whilst others retain variable quantities, according to the hygrometric state of the atmosphere. I do not pretend to say that definite quantities of water may not be retained, but only that in the phosphate and carbonate of soda the affinity which connects a certain proportion of water, the seventh, for instance, with the salt, is very little different from that which contains the proportion immediately above or beneath it.—*Annales de Chimie*, xxxvi. 334.

Purification of Alcohol.—A prize was offered by the Royal Academy of Brussels to the person who should prove upon what the differences between alcohol, extracted from various substances, as fruits, grain, roots, sugar, &c. depended. This was obtained by M. Hensmans, who was led, by numerous experiments, to conclude, that the alcohol was always identical, but, that the difficulty, more or less great, always found in rectifying it, as well also as the difference in taste, depended upon the presence of a fatty matter, and a little acetic ether. The fatty matter, when alone, may be separated by several distillations, but the acetic ether is not removed in this way. It is better, in every case, for the removal of both, to add a little caustic potash, or soda, to the alcohol, to be rectified. Carbonated alkali does not act with sufficient energy.—*Bull. Univer.*

NEW WORK.

We have much pleasure in announcing that Drs Wood and Bache are engaged in the preparation of a new Dispensatory, designed as a companion to the United States Pharmacopœia, and which will exhibit a complete view of the present state of Pharmacy. From the known talents and learning of these gentlemen, we are convinced that this work will be a valuable addition to the general stock of pharmaceutical knowledge.

OBITUARY.

DR BENJAMIN ELLIS.

We have the melancholy duty to perform of recording the death of this amiable and estimable physician. A severe attack of scarlet fever, operating on a constitution naturally delicate and impaired by sedentary habits, terminated his life on the 23d of April, in the thirty-fourth year of his age. Dr Ellis was rapidly rising in his profession, and few men were ever more beloved in their circle of intimate friends than he. His manners were simple, unaffected and cordial; and his temper and disposition cheerful, susceptible and generous. He was elected Professor of Materia Medica in the College of Pharmacy as a successor to Dr Samuel Jackson, and filled that station with great reputation and success for four or five years, up to the period of his death. He succeeded in infusing into the minds of the pupils an ardent love for science, and his name will be closely connected with the history of the progress of Pharmacy in this city. As the editor of this Journal, he was diligent and judicious; and his loss has been deeply felt and regretted by his coadjutors.

The modest worth—the mild intelligence and ardent enthusiasm of our deceased friend require at our hands this sincere tribute of respect and affection for his memory.



